

## ARCHIVES OF OTOLOGY.

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### A CASE OF OTITIC BRAIN ABSCESS (CHRONIC OTORRHŒA, OPTIC NEURITIS, HOMONYMOUS HEMIANOPSIA. OPENING OF MASTOID AND SKULL. CEREBRAL HERNIA. RECOVERY).

BY DR. HERMAN KNAPP, OF NEW YORK.<sup>1</sup>

Nov. 23, 1893, Mrs. John Burckhardt, of Long Island City, brought to me her nine-year-old daughter Mamie, with a letter from her physician, Dr. Anderson, which informed me that the child had been seen in consultation by Dr. Wm. Cowen and Dr. Fred. Peterson, of New York, who, from the aural and general symptoms and the presence of choked disc, had diagnosticated an intracranial abscess.

The thin, but otherwise healthy-looking child, whose father seems to be consumptive, had suffered for years from left-sided otorrhœa. For the last eight weeks there had been copious and offensive discharge, severe headache and some dizziness, with a temperature ranging from  $98.4^{\circ}$  to  $101^{\circ}$ .

I found the drumhead largely perforated, white-infiltrated, no swelling of the walls of the meatus. Mastoid neither swollen nor tender. No sensitiveness on percussion of the skull. Right ear in structure and hearing normal. Left ear  $h = 0$ ,  $v = \frac{1}{66}$ , both ears closed  $\frac{1}{66}$ . Choked disc marked in the left, moderate in the right eye. My assistant, Dr. W. A. Holden, whom I asked to examine her vision, reported  $S = \frac{3}{8}$  in each eye; homonymous, right-sided hemianopsia, the left half of the field of vision in both eyes normal; no hemianopsic pupillary reaction. I could easily confirm this statement; the answers of the child were clear, the lines of separation of the blind and seeing halves of each field lay in the vertical meridian. I ordered an

<sup>1</sup> Read in abstract before the American Otological Society, at Washington, D. C., May 29, 1894.

ice-bag on the mastoid, and syringing the ear with warm boric-acid water every few hours.

I asked the mother to permit me to present her child at my clinic at the College of Physicians and Surgeons. She came there a few days later, and I found the child much better in respect to her general symptoms; less headache, temperature almost always normal; otorrhœa copious and very offensive. The choked disc in the left eye and the hemianopsia were the same, but the swelling of the right optic disc had diminished. I told the students that I showed them the case to impress them with the idea that practically there was no such thing as specialism in medicine. Division of labor was legitimate and useful in medicine as in other departments of human work, but nobody who had educated himself in a specialty, at the expense of his general knowledge, could competently handle the majority of the patients in his own field. The little patient before them was etiologically a case of general practice—scarlatina, which, as a sequel, left a chronic ear disease; this in its extension had caused a brain trouble, the existence of which had been ascertained with the ophthalmoscope (choked disc); its differential diagnosis (between meningitis, sinus thrombosis, and abscess) lay in the sphere of the neurologist; and the seat of the disease, in our case the abscess, had been determined by the functional examination of the eye; whereas the cure, which in the case before them meant nothing less than the saving of life, could only be accomplished by the hand of the surgeon. I told the students why the existence of meningitis and sinus thrombosis could be excluded. The homonymous hemianopsia indicated the destruction of the optic-nerve fibres somewhere between the chiasm and the visual centre, the cuneus. The integrity of all other cranial nerves made it likely that it was situated in the cuneus or near it, in the occipital lobe. Dr. Fred. Peterson, who was present, and whom I asked for his opinion, said it might as well be in the optic radiation. This opinion I adopted so much the more willingly, as the optic-nerve fibres, in their course from the external geniculate bodies to the cuneus, pass through the temporo-sphenoidal lobe, in which, as experience has shown, the majority of otitic abscesses (about 66 per cent.) are located.

I ordered continuance of the treatment. Not having heard anything of the child for two weeks, I wrote to the father that, in my opinion, his little daughter suffered from a fatal disease

which could be cured by a surgical operation only ; whether he would not let me examine her again. He answered, "willingly," and I asked my colleague, Dr. M. A. Starr, to kindly see the child with me.

This was done at my office on December 10, 1893.

S  $\frac{2}{3}$  each, homonymous hemianopsia as before. Mobility of eyes and pupil normal ; optic disc in right eye almost normal, in left markedly choked, yet less than last time. Child has apparently been quite well, plays, sings, and has no discomfort. No indigestion, no constipation ; no mental trouble ; child reads and pronounces well. Several weeks ago her memory was feeble, and she could not recollect the names of her schoolmates, though she recognized them at once. Now her memory is good, she reads and knows what she reads. Her pulse is 120, and her temperature 100.2° at 3 P.M. A large perforation in the drum membrane. A probe can be introduced a short distance into the posterior part of the tympanic cavity toward the mastoid antrum ; no dead bone felt. The mastoid is slightly swollen and red, the tip tender on pressure. At the suggestion of Dr. Starr we tried Macewen's symptom and found it present, namely on applying our ear to the vertex of the patient, we heard the percussion of symmetrical points of the skull stronger on the left than on the right side.<sup>1</sup>

Dr. Starr and myself were of the opinion that we had to deal with an otitic brain abscess which should be opened. The father consented. The operation was done the next day, in the operating rooms of the N. Y. Ophthalmic and Aural Institute. Dr. Starr was kind enough to be present. It was quite a privilege for me to have his opinion in the discussion of the different phases of the operation, which from the shaving of the skull to the end of the dressing lasted almost three hours.

I began the operation with chiselling the mastoid open, making what is called the radical operation. The object was first of all to clear the ear of all the carious and necrosed bone, mortified tissue, and inspissated and decomposed secretions which, in a vicious circle, kept up the morbid process. The mastoid was compact, though rather soft. Two to three millimeters below the bone surface the lateral sinus came into view. It looked blue, healthy, and pulsated. I chiselled, around it, all the bony

<sup>1</sup> See Wm. Macewen's book, *Pyogenic Infectious Diseases of the Brain and Spinal Cord*, 1893, p. 146. Elicitation of a Differential Cranial Percussion Note.

wall away, until I came into a small cavity, the antrum. From there I passed a bent probe through the neck of the antrum, into the tympanic attic, and chiselled a groove through the bone, protecting the facial canal with a bent probe, and connecting the antrum with the attic. With a sharp spoon I now carefully cleansed the antrum and the attic, removing a good deal of brittle bone-tissue and cheesy, offensive material. When the walls of these cavities felt firm and hard like healthy bone, I desisted from going any farther in this direction. The offensive pus which during the first part of the operation escaped copiously through the ear canal, suddenly ceased to flow. It evidently came through the roof of the attic, but no fistula or trace of its course could be detected.

Two hours had elapsed in this tedious chiselling; my assistants grew tired, but convinced that an abscess was in the brain I did not want to stop here and leave the operation half done. I enlarged the skin wound upward and opened the skull in the usual place, above and behind the ear canal, with a trephine 2.5 *cm* in diameter. When the piece of bone was removed a healthy strongly pulsating dura mater presented; no softness on pressure indicated the presence of pus. I enlarged the wound with a rongeur, making its diameter over 3 centimetres. Then I incised the dura and found the pia and brain unchanged. Now I thrust the somewhat thick and long needle of a large hypodermic syringe 3-4 *cm* into the brain substance, from above and behind, down and forward toward the ear canal. There was no resistance at any place. I drew the piston up and the syringe at once filled with pus. Without withdrawing the needle I opened the abscess at once by thrusting a long-bladed knife along the needle until the pus flowed out freely. It was impossible to prevent the meninges and the edges of the trephine canal from being contaminated with the greenish-yellow, very offensive pus. When there was no further escape, the wound was cleansed with absorbent cotton, which had been wetted with a 1:5000 corrosive sublimate solution. The dura was put in its place, a hard rubber drainage tube inserted into the wound, and the region covered with sublimate gauze and absorbent cotton, held in position by a flannel roller.

The little patient, who had been under ether all that time, rallied quickly, felt no collapse, was carried to her bed, and soon slept soundly.

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The after treatment was long and laborious. The pulse accelerated (135-160), and the temperature rose during the following days (102.5°). The patient had no appetite, was very thirsty, but had neither pain nor any particular discomfort. The optic neuritis increased considerably. A perforated silver tube was kept in the ear canal, in order to keep the caliber of the canal free. The ear was syringed daily. It discharged pus freely, as did also the skull wound through the drainage tube, which was removed and replaced by a new one daily. From the third day the brain began to protrude through the perforation in the skull, more and more until the hernia reached the size of a goose's egg. The thick bandage was bathed in cerebro-spinal liquid which flowed freely through the upper part of the wound. Two sloughs made their appearance on the surface of the brain hernia, which I scraped off with a sharp spoon. Judging from the feel of fluctuation on palpitation, the continuance of the fever, and the increase of the optic neuritis, that there was probably another abscess or two in the temporo-sphenoidal lobe, I thrust a narrow knife into the brain substance under the sloughs, no deeper, however, than 2.5 *cm* lest I might open the lateral sinus. No result; but the next day there was a free discharge of pus from these incisions.

Now the *recovery began*, slowly but steadily. The flow of arachnoid liquid diminished and ceased in the third week, the prolapsed brain substance was red, but perfectly clean. It was cleansed daily, *i.e.*, irrigated with boric-acid water, strewn with impalpable boric-acid powder, covered with corrosive sublimate gauze, on which vaseline had been spread. In the fourth week the discharge from the ear and the brain diminished and soon stopped. The drainage tubes were left off. The patient felt better, ate and slept well, lost her thirst, had a morning temperature of 98.5° to 98.9°, an evening temperature of 99° to 100.3°. Pulse about 120. Gradually the pulse slowed, but the temperature remained 99° and 100° for more than two months. The cerebral hernia remained as large as a goose's egg for over six weeks, then it began to diminish, the skin crept over it from the border, and it became evident that the hernia was being gradually drawn back into the cranial cavity. Its surface was covered with healthy skin, on which the pulsations of the brain were still visible. The optic neuritis in both eyes began to diminish in the second month and had disappeared in the third. The hemianopsia has remained. The sight is the same. It is doubtful whether she has any hear-

ing in the ear operated on. She repeats words at a distance of twelve feet, but also at six to eight feet when both ears are closed. Her intellect is unimpaired. She is gay and lively, betraying, apart from her hemianopsia, in no way that her brain has suffered so seriously. She was kept at the hospital until March 22d, a little over three months, longer than was perhaps, necessary, but I wanted no imprudence or neglect to interfere with her recovery.

June 21, 1894, I saw her last. There are now no symptoms of brain disease, and the child is as well and lively as ever. In the depth of the ear canal there is still some secretion brought out with the cotton-tipped probe. This still requires the aurist's care, though the ear canal is wide and there is no polypus and no rough bone. The recovery will be complete only when there is no secretion and the bones are covered with cicatricial tissue.

As far as I can make out only one other case of cerebral abscess from ear disease has been operated on successfully in this country. Dr. L. A. Stimson published a case, March 30, 1891, in the *N. Y. Medical Journal*, cited in Starr's book (*Brain Surgery*, p. 194). He went through the bone with a chisel above and slightly behind the external auditory meatus. An incision through the dura gave exit to about three ounces of pus. The finger passed freely upward and downward. It was thought that an abscess had formed between the meninges, and not in the substance of the brain, and that it had especially compressed the posterior part of the temporal lobe in its inferior and outer surfaces. The patient eventually recovered entirely. Such cases are not so rarely successful. I have published some from my own practice. They get well when the pneumatic spaces behind and above the ear are freely opened and drained. They are the result of more or less extensive caries and necrosis in the roof and adjacent parts of the tympanum and mastoid process. The pus forms in the bottom of the middle or posterior cranial fossa, but travels also around the base of the petrous bone occupying both fossæ. I have seen this in a number of specimens.

The other case I alluded to above, is published in the April number of this year of the *Annals of Ophthalmology*

*and Otology*, 1894. It was under the care of Dr. Chas. H. Burnett, and operated on by Dr. De Forest Willard of Philadelphia. The case was particularly interesting from the fact that the presence of the abscess could be well enough diagnosed, but its location remained doubtful even as to which hemisphere it was in (both ears being affected) until paralytic symptoms fixed it in the neighborhood of the motor centre of one, in which it was readily found by the operation.

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CAN IMPORTANT TOPOGRAPHICAL RELATIONS OF  
THE TEMPORAL BONE BE DETERMINED FROM  
THE FORM OF THE SKULL? AS ANSWERED IN  
PART BY FIVE HUNDRED SKULL-MEASURE-  
MENTS.

BY DR. B. ALEXANDER RANDALL, PHILADELPHIA.

*(With three figures in the text.)*

THE affirmative answer which was given to this interesting question by Dr. Otto Koerner in these ARCHIVES, vol. xvi., p. 281, on a basis of sixty skull-measurements, enlisted at once the co-operation of the writer to put to further test the findings there set forth. A number of considerations delayed any decided effort to pursue the study, as it seemed important to make it fairly complete in its details and wide in its basis; and the contrary findings of Schueltzke and his divergent methods, raised further questions as to the best means to be employed in the research.

Koerner's method of orthographic projection necessitated sagittal division of the skull and limited too narrowly the extent of the material employed; while in the choice of the points selected for measurement its application is open to a huge personal equation, wholly undermining its conceded accuracy in other respects. Measurement by calipers, as done by Schueltzke and myself, has its confessed imperfections as applied to the undivided skull, since there is often an obliquity in the placing of the points which slightly exaggerates the minimum thickness of the bone at the place measured. Yet this is rarely if ever more than a fraction of a millimetre,

and varies from case to case in still more microscopic proportions. It can be absolutely asserted as to the figures that follow that in no single instance are they more than one millimetre astray in the larger dimensions, except that from sulcus to sulcus, which has been found at times as much as 2 *mm.* in error, and that in the small dimensions the data are accurate to a small fraction of a millimetre.<sup>1</sup> If any operator desires minuter approximations by which to guide his procedures, he is welcome to make more hair-splitting measurements for himself, as Koerner has more recently done to tenths of a millimetre on twenty-seven skulls. It is regrettable that these infinitely accurate results have so little practical use.

Studying the matter with the object of obtaining guiding anatomical facts, irrespective of proving or disproving the theory of Koerner, it has seemed of prime importance to employ a method sufficiently accurate to meet the needs of the surgeon, and applicable to almost any and every skull. Such a method and the instruments devised for applying it, was presented for criticism at the meeting of the American Otological Society in 1892, with illustrative data as to 122 skulls in the Hyrtl Collection in the College of Physicians of Philadelphia. The wider work embracing the available specimens in the Museums of the University and the Academy of Natural Sciences in Philadelphia and the United States Army (in Washington), has been carried forward to the extent of only one half of the intended one thousand; but has been presented in full detail in the transactions of the Pan-American Congress, so as to be fully available to others. Every specimen can be identified by its museum number, and any errors which I have made thus easily detected. As an aurist dealing principally with Caucasian races, such skulls were at first selected; and only when all such had been utilized were the unknown, aboriginal, or other unusual and perhaps unpractical specimens used. Finally, some selection of extreme types seemed

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<sup>1</sup> Koerner challenges my method and results (in this Journal, xxiv., p. 173, German edition) because absolute accuracy is not claimed and because his law can be demonstrated only upon the rare extreme forms. Rejoinder is needless.



admissible to fill out the series more symmetrically, every skull having the desired index being taken as it was found, irrespective of the showing made by its further mensuration.

As one thousand skulls seem small enough a series upon which to base any wide-reaching law which is expected to guide the surgeon, I hope that others will complete what has been thus begun, as it is not improbable that I cannot devote more time to the exacting study.

In the detailed presentation of my results, the effort has been made to offer to fellow-students each individual skull in all its important dimensions, leaving them to draw all conclusions for themselves. Hence the height is given as a check upon the introduction of deformed crania, the breadth between the parietal tuberosities for those who reject the inter-parietal maximum as giving the *index* when divided by the maximum length—the breadth at the *spina supra meatum* and at the "operation point" 5 mm behind it—the extreme separation of the sigmoid sulci and the minimum thickness of bone overlying each, and the distance of this thinnest point back of the *spina* upon each side—so that for every skull a scheme like the accompanying (Fig. 1.) can be constructed, showing the relations throughout. Others may differ in their methods of mensuration and in the points determined; but some at least of these must be measured, and the results will be thus far comparable. The height of the floor of the middle cerebral fossa above the *spina* was also determined with calipers and the relation of this lowest point within or beyond the *spina* was also recorded.

It is needless here to present the detailed findings elsewhere given; nor will I attempt to deduce laws of universal applicability from material which seems still insufficient; nor on the basis of the averages thus far obtained combat the theory of Koerner. Wider research may prove the correctness of his generalization. Yet it seems not invidious but of practical importance to see how far the facts which I have obtained accord with his results; and how far, as surgeons, we could have been aided or misled had we endeavored to apply his law to the individual skulls making up the series which I have studied.

Mesocephalic crania, or types approximating this, will doubtless always predominate in the operative work of European and American surgeons, although the negro and other stocks will furnish exceptions. The findings in 80 such skulls (index .777 to .779), as also the averages in the entire 500 have, therefore, considerable practical bearing.

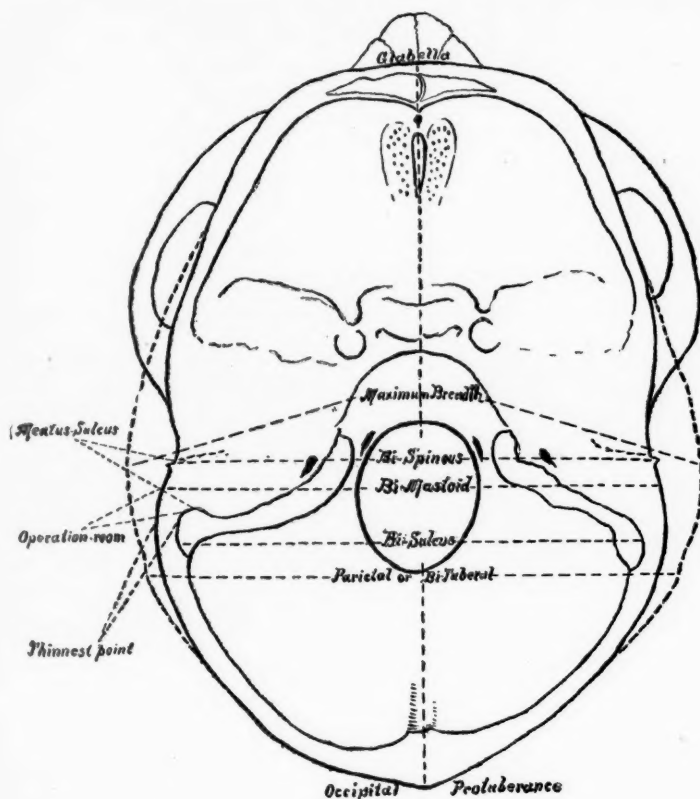


FIG. I.

Scheme showing the most important dimensions of a skull in the writer's collection.

The height of the floor of the middle cerebral fossa was measured in the vertical plane of the *spinæ* and in relation to them as the fixed points, as being more practical as well as more definite than its distance from the meatus, especially in its deeper portions; and this lowest position was located laterally, as thus much within or beyond the *spina*. In the 80 mesocephalic skulls, this floor averaged 6.27 mm (18 to 0)

above the *spina* on the right, and 5.94 mm (13 to 1) on the left side; being higher on the right in 41, on the left in 18, and equal in 21. Among the total 500 this height averaged 6.6 mm (18 to 0) right, 5.6 mm (15 to 0) left; being higher on the right with a maximum difference of 7 mm, 287 times, on the left (maximum difference, 5 mm) 102 times, and of equal height in 111. For the 210 brachycephalic skulls (index .780 to .97) and for the like number of dolichocephalic (.610 to .776), the average figures were almost identical with each other and with the general average. Selecting the 40 crania at each extreme of the series, we find for the ultra-dolichocephalic (index .61 to .71) an average of 5.42 mm (14 to 0) on the right and 5.87 mm (14 to 0) left; with the right fossa higher in 13, the left in 17, and equality in 10. This ghost of a confirmation of Koerner's law is overshadowed by the finding in the 40 ultra-brachycephalic (index .87 to .97), where the height averaged 6.6 mm (15 to 0) on the right, and 6 (15 to 0) mm on the left; with the right higher in 20, the left in 12, and the two sides equal in 8. Inconclusive as my figures may be in some respects, they certainly show that the middle cerebral fossa may be found at any height up to 15 mm above the *spina* on either side and in any type of skull, and it is rarely, if ever, below this landmark. That it was found lower on the left and in the dolichocephalic cranium on the average, shows the accidental character of Koerner's findings, but does not establish a law to the contradiction of his.

The thin point where the lateral sinus most nearly approaches the surface is found in the mesocephalic to average in thickness 6.17 mm (15 to 1) on the right, and 6.89 mm (18 to 2) on the left, being greater on the right in 22, on the left in 42, and equal in 16. In the total 500, the average was 6.1 (20 to 0) right, and 6.6 mm (18 to 0) left; it was thicker on the right in 151, on the left in 231, and equal in 118—the maximum difference being 6 mm for each side. This confirmation of Koerner's finding loses its scant importance when we note, as he has neglected to follow Bezold in doing, that this thinnest point lies generally well back of the operation-track, averaging 17.8 mm behind the *spina* (40

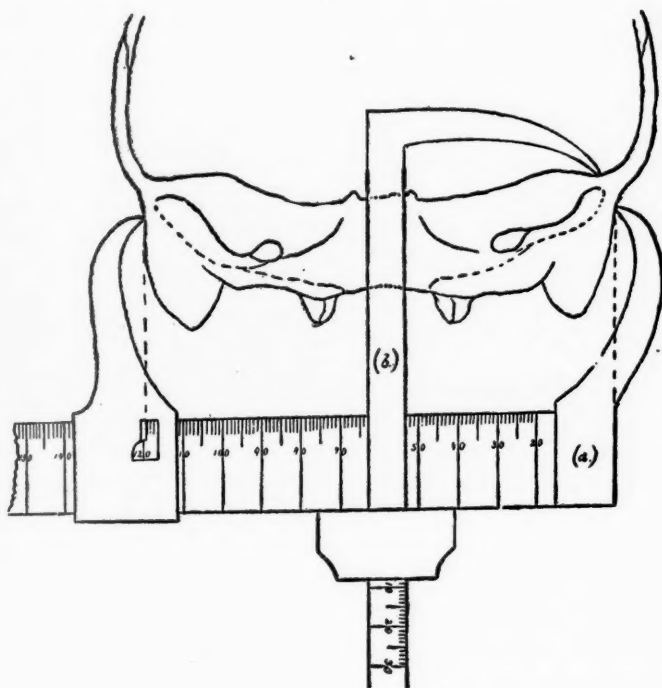


FIG. 2.

Scheme of the instrument employed to locate the lowest portion of the floor of the middle cerebral fossa and measure its relation to the spina supra meatum.

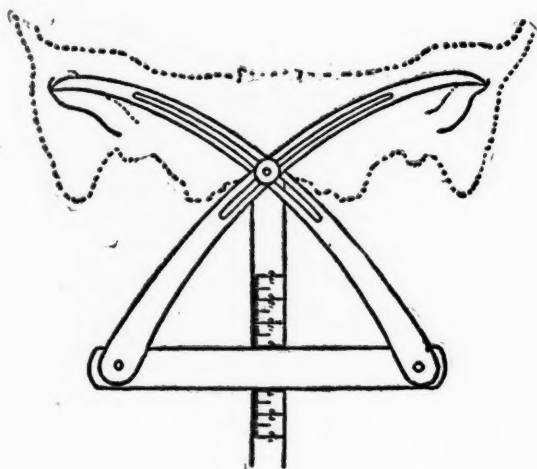


FIG. 3.

Inside calipers employed to measure the maximum distance between the sigmoid sulci.

to 0.5) on the right, and 17 mm (35 to 1) on the left in the 500; with slightly more difference in the mesocephalic (18.3 right, 16.8 left) and minima of 4 mm and 5 mm respectively. So, also, in the general groups of the long and the broad heads, the slightly more superficial position of the sinus in the brachycephalic and on the right side was neutralized by its more anterior position on the left and in the dolichocephalic. In the extreme examples of each type, the general finding was reversed, and the 40 ultra-broad skulls averaged 6.95 mm right and 7.53 mm left, as against 6.43 mm and 6.82 mm. in the 40 ultra-long. In each group the right was thinner in 11, the left in 19, skulls.

Turning to the figures for the distance between the sulcus and the posterior wall of the canal—a far more important dimension, since it defines the posterior limit of the field of operation—we find that here also there is generally less room on the right. In the 500 skulls it averaged 12.1 mm (21 to 0) right, 12.5 mm (25 to 0.2) left—being greater on the right (max. 6 mm) in 153, on the left (max. 8 mm) in 201, and equal in 146. The 80 mesocephalic crania showed less extreme dimensions and slightly greater space—12.55 mm (18 to 6) right, and 12.75 mm. (20 to 6) left. The large group of the long and broad heads again nearly corresponded with each other and with the general average, except that on the right the dolichocephalic had a lower average than the brachycephalic—11.4 mm: 12.3 mm. This was still more marked in the extreme examples, being 11.38 mm (20 to 0) right, and 12.7 mm (25 to 0.2) left in the 40 longest crania, but 12.95 mm (18 to 7) right, and 13.12 mm (18 to 3) left in the 40 broadest. It seems very noteworthy that 7 mm was the minimum meatus-sulcus distance found on the right side in the 60 most brachycephalic skulls (index .86 and over) which I have measured.

Important as are the foregoing data, another question naturally comes first to the mind of the surgeon when he has laid bare the mastoid and placed his chisel upon it ready to enter: How far is my instrument from the lateral sinus? This dimension has been determined for a point 5 mm. horizontally back of the *spina* and called "the operation room."



For the 500 skulls it averaged 11.3 *mm.* (20 to 0.3) right, and 11.8 *mm.* (25 to 0) left. The right was greater (up to a maximum of 9 *mm.*) in 159, the left (to 8) in 206, and there was equality 135 times. This equality was rather more common among medium crania, but was met in all types and with all dimensions from 1 *mm.* to 17 *mm.* In the mesocephalic the extremes were less marked and the two sides almost identical in average—11.79 : 11.84 *mm.* In the larger groups of the long and short crania the averages for the two sides were almost identical, but a full millimetre less for the dolichocephalic—11.7 and 12 : 10.8 and 11 *mm.* Still more marked was this reversal of Koerner's finding in the extreme cases of each type: The 40 hyper-dolichocephalic (20 with index below .70) averaged 10.81 *mm.* (20 to 0.2) and 11.45 *mm.* (25-0) left, in contrast to 12.85 *mm.* (16-4) right and 12.07 *mm.* (16-0.2) left in the 40 extremely broad heads—15 with index .91 to .97. On this showing the right temporal of a very short head would seem safer than the left, since in but one instance did it show less than 6 *mm.* between the operation-point and the sinus, which in all other specimens might be, as it often was, within a fraction of a millimetre of the point of attack. In not a few of the dangerous bones there is reason to hope that the large blood-vessel would have been discernible through the thin shell of bone which covered it.

The more superficial and anterior position of the right sinus, which is rather usual, is partly explained by its generally larger size. This long-known rule has often been exaggerated, perhaps because considered identical with that governing the size of the jugular fossa and foramen. This latter was larger on the right in 277 skulls and doubtfully so in 29 more; while the left was larger in 125, doubtfully so in 18 more, and equality existed in 51. Yet the jugular is made up of the inferior petrosal and the sigmoid sinuses and much of the blood of the latter vessels (all of it at times) may escape through the mastoid emissary to the external jugular. On the other hand, there is oftener discrepancy in the size of the foramen than of the sigmoid sulcus of each side, since the sulcus was larger on the right in 225, questionably

so in 53 more, was larger on the left in 128, doubtfully so in 47 more, and was equal in 47.

Inadequate as the material here reported upon may be for determining the general laws governing the average position of the dangerous structures in relation to the operation of opening the mastoid, it serves to demonstrate several important facts. Safe or dangerous relations with maximum or minimum dimensions of the intervening structures, may be found on either side and in any type of skull, although at one or two points my findings must be supplemented by others in order to prove that the right temporal bone of the ultra-brachycephalic cranium may ever present the most dangerous configuration, which Dr. Koerner holds to be its characteristic. Hence it follows that the surgeon can in no case be absolved from proceeding with his operation as though he were sure that the lateral sinus or the middle cerebral fossa lay so directly in his track that only the utmost care would avoid opening them unintentionally. The drill and trephine must be henceforth regarded as distinctly less safe than the chisel, as most operators of large experience have long held. The mastoid surface should be freely exposed and carefully scrutinized, since the lateral sinus may lie directly in the usual operating track, so superficial that it may be discerned through the thin bony covering. The upper posterior margin of the auditory meatus with its *spina* (which was lacking in but five among 200 temporals, each time on the right) constitutes the most reliable guide to the point of entry, since among more than 1100 temporals I have never found the middle cerebral fossa to extend lower than this, and the sigmoid sulcus almost never so far forward. The chiselling should begin as close as possible behind the *spina* and be carried cautiously inward, forward, and slightly upward, in those cases where the mastoid surface offers no special indications and the intention is to open the antrum. This cavity ought to be met at a depth of less than 20 *mm.* and deeper penetration is rarely safe, although my measurements would indicate that the facial canal and external semi-circular canal lie never less than 16 *mm* from a point 5 *mm* behind the *spina*.

## INVESTIGATIONS WITH TUNING-FORKS OF MIDDLE REGISTER IN OVER SIX HUNDRED CASES.

By HENRY A. ALDERTON, M.D., BROOKLYN, N. Y.

WHEN the investigator attempts to sift the truth from the mass of literature upon the tests with tuning-forks, he is confronted with two contentions directly opposed to each other. One author declares, and is quoted by numerous others, that he "doubts whether these experiments in any way facilitate our diagnosis"; another "considers the tuning-fork examination the most exact of all examinations of hearing which are now practised." All, however, deprecate the expenditure of time necessary to the performance of the tests. It is questionable how valid is this last objection; an ophthalmologist does not deem the time spent in determining refraction as altogether lost. Certainly if a thing is worth doing at all, it is worth taking the time to do well.

With the idea of determining personally the value or lack of value of the tuning-fork in ear work, the writer undertook, at the beginning of his clinical work, to have every possible case tested throughout Hartmann's series, and now presents the results of experiments extending over 1891 and part of 1892. In the hurry of clinical work, it was not possible to test all cases, but those tested were not in any way chosen to bolster any preconceived notions or ideas. The tests were performed either by the writer or by capable assistants, and the tables below represent the averages obtained.

Through the kindness of Surgeon Edward Kershner, U. S. N., a large number of men belonging to the United States Marine Corps were detailed for examination. These

men were purposely chosen to determine the normal reactions, because, having been subjected to a thorough physical and mental examination just previous to admission to the Corps, they were supposedly sound men of from eighteen to thirty years of age.

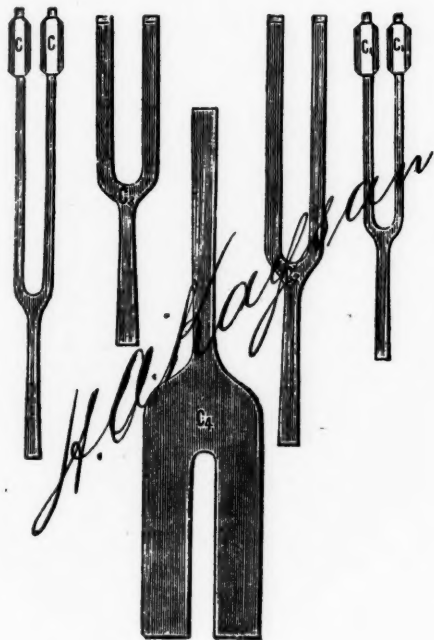
All possible precautions were taken to obtain accurate results, but these results must of necessity be of value only when compared with those obtained in investigating abnormal conditions with the same tuning-forks. In other words, each investigator must verify with his own instruments the normal reactions and use the results as a basis for comparison with those obtained in abnormal conditions. The reason for this lies in the fact that it is almost impossible to have any one series of forks correspond exactly with another, even when manufactured by the same man.

It will prove of value, perhaps, to briefly recall the normal reactions. All tuning-forks are perceived equally from the vertex, forehead, or teeth; as a precaution, always strike directly in front of the patient, so that neither ear gains the advantage of air conduction. All forks are heard longer by air conduction than by bone (Rinné). When one meatus is occluded artificially, the tuning-fork placed on the mid-skull is heard better by bone conduction in the occluded ear (Weber). With both ears normal the tuning-fork is heard equally well in both ears. Intensity of sound and duration do not correspond in the normal ear (Emerson). By air conduction, the tone also becomes audible anew for a few seconds after removal, when it has ceased to be heard. This also holds by bone conduction, if the meatus be occluded after the sound is no longer perceived (Bing). The average upper tone limit is about indicated by the mark 2.03 Galton (Bezold). This, however, varies very considerably with the make, so that anything above 2.05 may be considered fairly normal. The average lower tone limit is 17.04 v. (Bezold). Even still lower can be detected, but practically under 26 v. (Dench) is uncertain by AC. By BC, the writer has found that even with a fork vibrating 32-64 v. doubt often arises as to whether it is the sound or the vibration that is perceived, in comparing with AC.

It has been said that tuning-forks do not vibrate for so

long a period after use as when new, but that the note remains unchanged (Emerson). The writer has not noticed any particular decrease in the duration of perception after three years of use of the same set, but has noticed that the tuning-forks have a tendency to give forth with more emphasis the overtones. It is best, except with the heaviest  $C^{\text{iv}}$  fork, to establish the note by a flat stroke upon the bent knee, and the same result may be accomplished with the  $C$  fork by means of a stroke upon a thick piece of rubber. A fair stroke gives a very uniform reaction. In obtaining BC the stem of the tuning-fork should be firmly pressed upon the mastoid just over the situation of the mastoid antrum. Repeated testing in the same person diminishes the duration (Schwabach). By engaging the patient in conversation throughout the course of the test, this objection can be overcome to all intents and purposes.

Hartmann's series were employed, comprising forks  $C=128\text{v.}$ ,  $C'=256\text{v.}$ ,  $C''=512\text{v.}$ ,  $C'''=1024\text{v.}$ , and  $C^{\text{iv}}=2048\text{v.}$ , as imported from Germany by Mr. Kaysan, 34 Bond Street, Brooklyn, to whose kindness the writer is indebted for the appended cut. Hartmann has employed a fractional





method of graphic representation which seems to be too cumbersome and confusing. Each investigator quickly learns the normal responses of his own set of tuning-forks and then can easily use them for comparison. For communications they can be placed in juxtaposition with the abnormal, as a control.

The method of graphic representation in use by the writer is planned out by means of a stamp as below :

Rinné					
Schwabach	AC				
	BC				
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

For brevity AC=air conduction, BC=bone conduction. The Rinné being described as BC,=, or AC, according as in intensity BC is heard louder than, equal to, or worse than AC. In squares opposite Schwabach, the duration by air conduction, in seconds, is placed above, and that by bone conduction below, thus giving the duration Rinné as well at a glance. The lower line of squares is used to designate the tuning-fork whose reaction appears above. It must be apparent that but a moment is required to notice any deviation from the known normal, when presented after this plan.

Among the men offered, thirty-six absolutely normal ears were found, giving the following average. The watch was heard over 8 ft., the whisper 24 ft. + (all the distance obtainable).

Normal hearing—36 cases :

Rinné	AC	AC	AC	AC	AC	
Schwabach	AC	25	15	33	32	22
	BC	13	7½	13	13	14
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>	

We thus see that the classical formula AC twice as long as BC (Emerson) holds fairly well, but the proportion for high notes is not much, if any, greater than for low notes—as contrast C<sup>iv</sup> with C. All the forks were heard AC > BC. Variations in duration were found to occur, but they were generally within the range of personal error, very seldom varying two or three seconds above or below the average for AC and still less for BC, and this was greatly lessened upon considering the whole ground.

Many cases of normal hearing distance for the watch and whisper were found, which, nevertheless, either subjectively or objectively, gave evidence of the existence of some abnormality in other directions.

Normal hearing distance, but giving symptoms—52 cases:

Rinné	=	AC	AC	AC	AC
Schwabach $\left\{ \begin{array}{l} \text{AC} \\ \text{BC} \end{array} \right.$	24 15	23 $\frac{1}{2}$ 13 $\frac{1}{2}$	33 15 $\frac{3}{4}$	30 $\frac{1}{2}$ 15 $\frac{3}{4}$	24 15 $\frac{1}{2}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

The most marked difference consists in the uniform increase in duration of BC, which is probably to be accounted for, as indicated by the C fork, by some interference with the motility of the sound-conducting apparatus, also, perhaps, to some hyperæsthesia of the nerve terminals produced by sympathetic congestion (?).

It was thought that the examination of cases of impacted cerumen both before and after removal, without the institution of any treatment in the interim, should prove interesting. This was carried out in twenty-seven cases, in all the hearing being restored practically to the normal by the simple removal of the plug.

Cerumen, with return to normal hearing after removal—27 cases.

Before :

Rinné	BC	BC	AC	AC	AC	
Schwabach {	AC	16½	18	22½	21½	17½
	BC	16	12¾	15½	16¾	11½
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

After :

Rinné	=	AC	AC	AC	AC
Schwabach $\left\{ \begin{array}{l} \text{AC} \\ \text{BC} \end{array} \right.$	23 $\frac{1}{2}$	24 $\frac{3}{4}$	31 $\frac{3}{4}$	29	26
	14 $\frac{1}{2}$	12	13 $\frac{3}{4}$	13	15
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

In the first diagram the proportion between AC and BC is reduced throughout, the AC being lessened in duration and the BC being greatly increased, except for the C<sup>IV</sup> fork, which is what we would naturally expect, the sound-conducting apparatus being very little concerned in the transmission of very high notes (Bezold, Siebenmann). Intensity Rinné gives the forks C and C' negative.

The immediate effect of removal is seen in that now no fork gives intensity—R and only the C fork gives =. The AC is increased in duration throughout and BC diminished, except for the C<sup>IV</sup> fork, where it is increased. This last point would seem to be an argument against the idea that labyrinthine tension would increase the duration of bone conduction, for here in a typical affection of the sound-conducting apparatus, we have increased duration for all forks except the highest, which should be the first affected, before removal, and after removal there is a fall in duration of all the forks except the highest, which immediately responds with increased duration, as though relieved from a strain.

*It would seem from this that increased labyrinthine tension would give decreased duration of bone-conduction, beginning with the high notes.*

The above findings are in opposition to the views of Eitelberg. "In the case of bilateral accumulation of cerumen, no change in the duration of BC was obtained after removal of the plugs," notwithstanding no other treatment was instituted, and confirms Schwabach's, "We see, therefore, that in the majority of cases of unquestionably peripheral ear disease in which — R resulted, not only was BC considerably prolonged above the normal, but also that *in most cases the duration became almost or quite normal when normal conditions had been restored*" (the italics are the writer's). "For I found that the duration in disease of the sound-conducting apparatus is much longer than in health."

As of interest, for comparison, the average in twenty-nine cases of cerumen before and after removal follow, the hearing being improved but not to normal.

Cerumen—improved, but not to normal hearing after removal—29 cases.

Before :

Rinné	BC	BC	AC	AC	AC
Schwabach {	AC	13	14½	18	16½
	BC	13	10¾	12½	13½
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

After :

Rinné	=	AC	AC	AC	AC
Schwabach {	AC	19	20½	26½	22¾
	BC	12½	9¾	10½	12
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

The foregoing twenty-nine cases were chosen without reference to the middle ear or labyrinth complications which existed. In a few the C<sup>IV</sup> fork was not heard at all before removal of cerumen, but was heard after, perhaps through air, though the meatus was artificially occluded for the high notes in determining bone conduction. In the two series, those giving normal, and those not, after removal, the intensity Rinné gives practically the same reactions, but the duration by AC before removal is more reduced throughout the scale in the complicated cases, just as by BC it is not increased, in fact the duration by BC is practically decreased as compared with the normal. In those not giving normal, after removal, we find the duration of AC increased, but not nearly to the normal, and the BC is diminished except in the C<sup>IV</sup> fork, *thus again showing that an affection of the sound-conducting apparatus increases the duration for bone-conduction except for the highest notes.*

Forty cases of cerumen with great improvement in hearing after removal, but no tests, were next averaged.

Cerumen with great improvement in hearing after removal—40 cases.

Before:

Rinné		BC	BC	AC	AC	AC
Schwabach	AC	12½	12½	17	15¼	14
	BC	13¾	11½	14½	14	9½
T.-F.		C	C'	C''	C'''	C <sup>IV</sup>

The duration by bone conduction is better than in those cases not giving normal, and not quite so good as in those giving normal after removal, so that the three conditions react to the order good, better, best.

Thirty-two cases of tubal obstruction due to adenoids, and twenty-one cases of tubal catarrh, giving immediate marked improvement upon treatment, are placed together



for comparison, because the changes produced in the middle ear are of much the same character.

Tubal obstruction due to adenoids—32 cases:

Rinné	BC	BC	BC	BC	AC
Schwabach {	AC	12 $\frac{3}{4}$	13 $\frac{3}{4}$	20	17 $\frac{1}{2}$
	BC	16 $\frac{1}{4}$	14 $\frac{1}{2}$	22 $\frac{1}{4}$	17 $\frac{1}{4}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Tubal catarrh, giving immediate marked improvement—21 cases:

Rinné	BC	BC	=	=	AC
Schwabach {	AC	16 $\frac{3}{4}$	15 $\frac{1}{2}$	22	19 $\frac{3}{4}$
	BC	14	13 $\frac{3}{4}$	19 $\frac{3}{4}$	15
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Two factors enter into the greater duration of bone conduction throughout and the ascending or climbing up the scale of the intensity Rinné BC > AC to the high notes in adenoids as contrasted with tubal catarrh; one is the greater youthfulness of the patient, and the other, the greater strain or tension put upon the conducting apparatus, because of the longer duration of adenoids. In both of these typical obstructors of the sound-conducting apparatus, BC is greatly prolonged, especially for the lower C forks.

In an examination of fourteen cases of otitis media sub-*acuta*, the following averages were obtained. No special choice of cases was made, it being impossible always to see the cases after recovery in order to exclude any complication:

Rinné	BC	=	AC	AC	AC	
Schwabach	AC	16	14½	18	14½	15
	BC	13	11½	12¼	13½	10¼
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Bezold's statement that in otitis media subacuta an abbreviated positive result (by duration) is obtained, is therefore confirmed, but were intensity employed instead, the C and C' forks would give negative Rinné. The duration of bone conduction is slightly reduced, though not sufficiently to indicate any appreciable labyrinthine lesion.

It is held almost universally that otitis media purulenta acuta is simply a more intense inflammation than otitis media catarrhalis acuta, and with this the writer agrees, and hence groups their tests together.

Otitis media catarrhal. acuta—9 cases:

Rinné	BC	BC	BC	BC	AC	
Schwabach	AC	10 $\frac{3}{4}$	11	15 $\frac{3}{4}$	11 $\frac{1}{4}$	14 $\frac{3}{4}$
	BC	15 $\frac{1}{4}$	11 $\frac{3}{4}$	13 $\frac{1}{2}$	12 $\frac{3}{4}$	9 $\frac{3}{4}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Otitis media purulenta acuta—51 cases:

Rinné	BC	BC	BC	=	=	
Schwabach	AC	7 $\frac{3}{4}$	9	12 $\frac{1}{2}$	12	11 $\frac{3}{4}$
	BC	14 $\frac{1}{4}$	12	16 $\frac{1}{2}$	14 $\frac{1}{2}$	10
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Otitis media purulenta recurrens—18 cases :

Rinné		BC	BC	BC	BC	=
Schwabach	AC	8	8 $\frac{1}{4}$	13 $\frac{1}{4}$	14 $\frac{3}{4}$	13
	BC	13 $\frac{3}{4}$	11	17	16	12
T.-F.		C	C'	C''	C'''	C <sup>iv</sup>

The duration of air conduction is practically about the same in all three, except that the greater resistance existing in the sound-conducting apparatus is evidenced by the lessened duration for the lower forks in otitis media purulenta acuta and recurrens. The intensity negative Rinné climbs farther up the scale in otitis media purulenta acuta and still more in otitis media purulenta recurrens. The duration of bone conduction becomes greater as the resistance becomes greater.

In studying these diagrams it is proven that Bezold's statement that in acute middle ear inflammations we obtain, despite well-marked diminution of the hearing, an abbreviated positive Rinné, does not hold as a rule. The increased duration of bone conduction in otitis media purulenta recurrens over otitis media purulenta acuta, the intensity of the inflammation being presumably much the same, if not greater in otitis media purulenta acuta, is due in all probability to the fact that in otitis media purulenta recurrens, because of the previous attacks, there is more infiltration and cicatrization and therefore more resistance to sound conduction.

One hundred and nineteen cases of otitis media purulenta chronica were divided into those with moderate impairment of hearing and those with great impairment of hearing.

Otitis media purulenta chronica with moderate impairment of hearing—whisper heard over ten feet—53 cases :

Rinné	BC	BC	=	=	AC	
Schwabach	AC	10 $\frac{3}{4}$	12 $\frac{1}{2}$	16	17 $\frac{1}{2}$	16 $\frac{1}{4}$
	BC	15	16 $\frac{1}{4}$	16 $\frac{1}{4}$	15 $\frac{1}{2}$	13
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Otitis media purulenta chronica with great impairment of hearing-whisper heard under 10 feet—66 cases :

Rinné	BC	BC	BC	BC	=	
Schwabach	AC	7 $\frac{3}{4}$	9	12 $\frac{1}{2}$	12	11 $\frac{3}{4}$
	BC	14 $\frac{1}{4}$	12	16 $\frac{1}{2}$	14 $\frac{1}{2}$	10
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>	

In those with great impairment of hearing, the intensity negative Rinné has climbed farther up the scale, and the duration of bone conduction is practically uniformly reduced throughout, showing an evident, though slight, beginning involvement of the labyrinth, as from the previous experiments the duration, if the labyrinth were intact, should be, if anything, slightly more than in the first. Practically we see that Barr was right. "The striking fact as to the almost invariable preponderance of BC (by Rinné) in otitis media purulenta chronica, proves how seldom the labyrinthine structures are involved in these cases," but still in cases of long duration there is a slight decrease in duration of BC, and though "also increased perception by BC" above the normal, as a rule, the increase is less than it should be for the amount of obstruction present of the sound-conducting apparatus, and hence we must infer a beginning impairment of nerve acuteness. One is struck by the fact that, notwithstanding the great disturbance in the tension of the sound-conducting apparatus, as must surely be present in

these latter cases, there is apparently no corresponding influence upon nerve response.

Simply as curiosities and, because of their number, with no intention to draw any comparison, two classes of Shrapnell's cases are appended.

Without involvement of the membrana vibrans—6 cases :

Rinné	BC	BC	BC	BC	AC
Schwabach {	AC	7½	10	13½	12
	BC	14	9½	15½	10½
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

With involvement of the membrana vibrans—4 cases :

Rinné	BC	BC	BC	BC	=
Schwabach {	AC	8¾	6¾	17	15
	BC	15	9¾	17¼	10½
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Under the name of otitis media purulenta residuosa are classed those cicatricial conditions of the tympanum the result of a healed otitis media purulenta. Seventy-four cases were tested and were divided into three classes—those with slight, moderate, and great impairment of hearing.

Otitis media purulenta residuosa with slight impairment of hearing—19 cases. Watch heard 2 ft., whisper 15 ft. + :

Rinné	BC	BC	AC	AC	AC
Schwabach {	AC	17	17	23	21
	BC	13½	11	14¼	13
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Otitis media purulenta residuosa with moderate impairment of hearing—30 cases. Watch heard under two ft., whisper 8-16 ft. +:

Rinné	BC	BC	=	AC	AC
Schwabach {	AC	12½	13¾	18½	16½
	BC	13	10½	13	11
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Otitis media purulenta residuosa with great impairment of hearing—25 cases. Watch heard under 9 in., whisper under 8 ft.:

Rinné	BC	BC	BC	BC	AC
Schwabach {	AC	8½	10	12½	11½
	BC	14	11¼	15½	8½
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

There is virtually no difference in the duration of bone conduction in those cases of slight and moderate hardness of hearing, but the greater obstruction to hearing is indicated in the latter by the diminished duration of air conduction and the climbing up the scale of intensity  $BC > AC$ . This ascending tendency is still further noticeable in those with great impairment of hearing, but with this there is diminished duration of bone conduction for the C''' and C<sup>IV</sup> forks, though the lower forks have increased duration of bone conduction. This would seem to point to the labyrinth as somewhat at fault, probably because of the greater and perhaps more prolonged strain that it was subjected to in a



middle-ear inflammation of sufficient intensity to produce such an amount of deafness after healing. This would seem to emphasize Dench's contention that because of the blood supply the lower turn of the cochlea (the seat of perception for the highest notes) is that first affected in labyrinthine involvement due to middle-ear inflammation. If the duration of BC in these cases be compared with that obtained in the normal, it will at once be seen that there is no real increase, thus conflicting with Bezold, who found in remains of otitis media purulenta the BC considerably intensified and lengthened.

In order to accentuate the difference in the reactions between real affections of the sound-conducting and of the sound-perceiving apparatus, the next diagrams given will be those of evident nerve disease, without any distinction being made as to peripheral, trunk, or central affections.

Nerve with great impairment of hearing—7 cases. Whisper heard under 2 ft :

Rinné	AC	AC	AC	AC	AC	
Schwabach {	AC	17 $\frac{1}{4}$	15 $\frac{3}{4}$	19 $\frac{1}{2}$	11	10
	BC	8 $\frac{1}{2}$	7 $\frac{3}{4}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	1 $\frac{1}{4}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Nerve with considerable impairment of hearing—10 cases. Whisper heard 2 to 10 ft. :

Rinné	AC	AC	AC	AC	AC
Schwabach $\left\{ \begin{array}{l} \text{AC} \\ \text{BC} \end{array} \right.$	12 $\frac{3}{4}$	16 $\frac{1}{4}$	20	17 $\frac{1}{2}$	10
	8 $\frac{3}{4}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	3 $\frac{1}{2}$	1 $\frac{1}{2}$
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Nerve with moderate amount of hearing—4 cases. Whisper 10 ft. + :

Rinné	AC	AC	AC	AC	AC	
Schwabach {	AC	22	23½	26¾	22½	17¼
	BC	11¼	7½	7¼	7	5½
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

As reason would dictate, the duration of air conduction progressively improves as the hearing is better, when the field as a whole is taken into consideration. This also occurs with bone conduction, but there is more irregularity in this.  $AC > BC$  exists throughout both by duration and intensity. Gaps in the series were noticed only in the considerably and greatly hard of hearing cases (in two out of seven of the latter, and in one out of ten of the former). In those with great hardness of hearing, all but one case showed one or more of the higher forks not heard at all by BC, and of these, four could not hear the C'', three the C''', and five the C<sup>iv</sup> fork; two could not hear any fork above C'. AC was present throughout the series in all the cases. In those with considerable hardness of hearing, seven could not hear one or more of the higher forks by BC; one could not hear any fork above C'. AC was present throughout the series in all the cases. In those with moderate hardness of hearing, all forks were heard by BC, but the duration was much less than in the normal.

As Schwartze says, retained BC only proves the trunk of the auditory nerve and its centre to be sound, but does not necessarily imply a healthy condition of the labyrinth, so does this explain the cases of more or less destruction of the cochlea with retention of BC and of a certain degree of hearing. Barr found in labyrinthine diseases,  $AC > BC$  in 80%, and in one hundred deaf boiler-makers, only 10% gave  $BC > AC$ . In the above cases both intensity and duration

of AC was greater than BC throughout the series wherever heard.

These same cases were observed long enough to again class them under three divisions, as to which were not improved, which were slightly improved, and which were markedly improved through treatment, the tests being the same as those above, simply rearranged.

Nerve disease with no real improvement—16 cases:

Rinné	AC	AC	AC	AC	AC
Schwabach {	AC	16 $\frac{3}{4}$	17 $\frac{3}{4}$	21	15 $\frac{1}{4}$
	BC	10	7 $\frac{1}{2}$	6	4 $\frac{1}{4}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Nerve disease with slight improvement—3 cases:

Rinné	AC	AC	AC	AC	AC
Schwabach {	AC	14 $\frac{3}{4}$	18 $\frac{1}{4}$	24 $\frac{1}{4}$	22
	BC	6 $\frac{1}{4}$	6 $\frac{1}{4}$	4	4 $\frac{1}{4}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Nerve disease with marked improvement—2 cases:

Rinné	AC	AC	AC	AC	AC
Schwabach {	AC	12 $\frac{1}{2}$	13	18	16 $\frac{1}{2}$
	BC	7 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	4
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Thus sixteen cases in twenty-one were not improved at all, notwithstanding that treatment was experimentally di-

rected to both the middle and internal ear. Also these tests apparently give no aid as to prognosis, the duration of BC following no rule.

Fifty-six cases of otitis media catarrhalis chronica were examined; of these there were:

Otitis media catarrhalis chronica with great impairment of hearing—25 cases:

Rinné	BC	BC	BC	BC	=	
Schwabach {	AC	5 $\frac{3}{4}$	5 $\frac{3}{4}$	10 $\frac{1}{2}$	11	10 $\frac{3}{4}$
	BC	15	11	16	13 $\frac{1}{4}$	9 $\frac{1}{2}$
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>	

Otitis media catarrhalis chronica with considerable impairment of hearing—19 cases:

Rinné	BC	BC	BC	=	AC	
Schwabach {	AC	$7\frac{3}{4}$	$10\frac{1}{2}$	$12\frac{3}{4}$	$12\frac{3}{4}$	$13\frac{3}{4}$
	BC	16	$13\frac{1}{2}$	$17\frac{1}{4}$	$13\frac{1}{2}$	9
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Otitis media catarrhalis chronica with moderate impairment of hearing—12 cases:

Rinné	BC	BC	=	AC	AC	
Schwabach {	AC	9	11	15 $\frac{3}{4}$	18	16
	BC	13	10 $\frac{1}{4}$	14	12 $\frac{3}{4}$	10
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

As the hearing is more involved we find the intensity  $BC > AC$  ascending the scale. The duration of air conduction is mainly affected in the lower forks. In the cases with moderate impairment the duration of BC approaches more nearly to the normal, whereas in the others the duration is increased, in the cases with great impairment falling slightly as compared with the considerably impaired cases, thus hinting at the beginning labyrinth sequela. When the reactions above are compared with those obtained in self-evident affections of the external or middle ear (as cerumen, otitis media purulenta, etc.) no one would hesitate to brand them as being produced by a middle-ear inflammation with little or no labyrinthine involvement. Bezold's declaration that in otitis media catarrhalis chronica the lower forks are heard longer than the normal, the upper about normal by BC, is confirmed. Among these fifty-six cases, six were found in which +R resulted for a certain fork and -R for the next higher, both by duration and intensity, hence proving exceptions to Bezold's inference that "such a possibility seems physically excluded." The writer was also able to confirm Bezold's statement that the duration of AC is shortened in otitis media catarrhalis chronica to complete absence of perception of deep and moderately high notes, with the proviso—or to great diminution. In no case was there a gap in the series.

The above cases of otitis media catarrhalis chronica were observed sufficiently long to divide them again according to the improvement received through treatment, the tests being the same rearranged.

Otitis media catarrhalis chronica not improved—11 cases :

Rinné	BC	BC	BC	BC	=
Schwabach {	AC	$7\frac{3}{4}$	$10\frac{1}{2}$	$13\frac{3}{4}$	$15\frac{3}{4}$
	BC	16	$12\frac{3}{4}$	17	16
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Otitis media catarrhalis chronica slightly improved—8 cases :

Rinné	BC	BC	BC	=	AC	
Schwabach	AC	5 $\frac{3}{4}$	6 $\frac{1}{2}$	10 $\frac{1}{4}$	12 $\frac{1}{4}$	11 $\frac{3}{4}$
	BC	14 $\frac{1}{2}$	13 $\frac{1}{4}$	15 $\frac{3}{4}$	11	7 $\frac{1}{2}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	

Otitis media catarrhalis chronica moderately improved—11 cases :

Rinné	BC	BC	BC	=	AC
Schwabach	AC	7½	9½	12¼	15
	BC	14¾	11	14	12¼
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Otitis media catarrhalis chronica considerably improved—6 cases :

Rinné	BC	BC	BC	BC	AC
Schwabach $\left\{ \begin{array}{l} \text{AC} \\ \text{BC} \end{array} \right.$	8	$9\frac{1}{4}$	15	$13\frac{3}{4}$	$13\frac{3}{4}$
	16	$12\frac{1}{4}$	$15\frac{1}{2}$	$13\frac{1}{2}$	8
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Otitis media catarrhalis chronica greatly improved—18 cases :

Rinné	BC	BC	BC	BC	AC	
Schwabach	AC	6 $\frac{3}{4}$	6 $\frac{3}{4}$	11 $\frac{1}{2}$	11	12
	BC	14	10 $\frac{1}{2}$	17	13	9 $\frac{1}{2}$
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>	



Thirty-seven cases in fifty-six were either moderately, considerably, or greatly improved ; eight were slightly, and only eleven were not improved ; 80 per cent. improved as against only 31 per cent. of nerve cases. After carefully reviewing the above tables one is compelled to the conclusion that no reliable help as to prognosis can be obtained in otitis media catarrhalis chronica by means of either Schwabach's or Rinné's test, unless it be that whenever intensity Rinné  $BC > AC$  or  $BC = AC$  reaches the  $C^{IV}$  fork, treatment is almost hopeless. Further work along the same line, already undertaken, may, through a larger experience, give the same or different result.

Dr. Roosa, in a written communication, defines presbykousis, a term of which he is the originator, as an atrophic condition of the tympanic muscles coincident with a similar lesion of the acoustic terminal filaments, and believes "that it is a common, if not universal, condition of things in people of more than fifty years of age." As, from observation, the writer believes that such a condition does truly exist, *i.e.*, a lack of function in the middle ear and nerve apparatus in elderly people, the tests taken in such cases are next presented as being without doubt representative of a combination of lesions of the nerve and middle ear. These cases are usually susceptible of immediate improvement through treatment directed to the middle ear, even without any attention to the nerve structures. The reactions were obtained from cases that were improved by treatment.

Presbykousis—11 cases :

Rinné	=	AC	AC	AC	AC
Schwabach {	AC	12 $\frac{3}{4}$	11	15	12 $\frac{1}{2}$
	BC	8 $\frac{1}{4}$	6 $\frac{1}{4}$	5	5
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

By AC the tuning-forks were heard throughout, except in one case in which the two lower forks were not heard. By BC two cases did not hear the  $C'$  fork, five the  $C''$ , six the

C''', two the C<sup>iv</sup>; two cases heard no fork above C; four cases showed gaps for either C'' or C''', or both. It is believed that C<sup>iv</sup> fork may have been heard through air conduction notwithstanding precautionary closure of the meatus with the finger. Emerson's statement was found to apply that "BC may be entirely lost and yet AC continue to a limited extent." His statement that "if the proportion between BC and AC remains the same, and the hearing power much lessened, it is probably an indication of disease of the internal ear" was found to apply as well to "mixed" cases.

Thirty-five cases of evident otitis media et interna ("mixed cases"—Roosa) were examined with the following averages.

Mixed cases, with great impairment of hearing. Whisper heard under 2 feet—17 cases:

Rinné	BC	BC	=	AC	AC
Schwabach {	AC	8½	7½	9½	7¾
	BC	10¾	9¼	7	5¼
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Mixed cases, with considerable impairment of hearing. Whisper heard 2-10 feet—13 cases:

Rinné	BC	BC	AC	AC	AC
Schwabach {	AB	8¾	9	12	10¼
	BC	10½	8	8¼	6
T.-F.	C	C'	C''	C'''	C <sup>iv</sup>

Mixed cases, with moderate impairment of hearing.  
Whisper heard 10 feet—5 cases :

Rinné	=	=	AC	AC	AC	
Schwabach {	AC	16½	19½	21½	24	18
	BC	8	7½	7	7	7
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>	

In the first group four cases could not hear the C and C' forks by AC, two the C'' fork, two the C''' fork; all heard the C<sup>iv</sup> fork. Gaps existed in two cases, the C'' and C''' forks being the sufferers. By BC, C and C' forks were heard in all, two did not hear C'', three C''', and eight C<sup>iv</sup>. There were no gaps by BC. In the second group, the C fork was not heard by AC in one case, the other forks being heard throughout. By BC, one case did not hear C''', and two C<sup>iv</sup>. There were no gaps by either AC or BC. In the third group, all forks were heard throughout by both AC and BC.

A study of the tables and explanatory remarks will make it apparent that the lower forks were more constantly heard by BC and less constantly by AC, and the higher forks more constantly by AC and less constantly by BC, demonstrating the double nature of the lesion. For claiming in these cases labyrinthine involvement, we have the authority of Emerson, Bezold, Cholewa, Politzer, and others. The above reactions show how important it is that thorough tests should be applied before resorting to ossiculectomy, for it is manifest that when the nerve is involved to a considerable or great extent, but little can be hoped from the operation.

These reactions were again apportioned according to the improvement secured by treatment.

Mixed cases with no real improvement—4 cases :

Rinné	BC	BC	=	=	AC
Schwabach {	AB	9½	10	11½	16
	BC	12½	10½	12½	8½
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Mixed cases with slight improvement—13 cases :

Rinné	BC	BC	AC	AC	AC
Schwabach {	AC	10½	10	12½	10½
	BC	9	7½	6½	4½
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Mixed cases with moderate improvement—5 cases :

Rinné	=	BC	=	AC	AC
Schwabach {	AC	14	14	16	14
	BC	11	9½	7	6
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

Mixed cases with considerable improvement—14 cases :

Rinné	BC	BC	AC	AC	AC
Schwabach {	AC	8½	8½	11	9½
	BC	10½	9	7½	5¾
T.-F.	C	C'	C''	C'''	C <sup>IV</sup>

About 52 % were more than slightly improved, while in otitis media catarrhalis chronica over 62 % were correspondingly improved, and in nerve less than 10 %.

In the first group, AC was present throughout, and by BC only C<sup>iv</sup> was not heard by one case. In the second group, two cases did not hear C by AC, one C'; by BC two did not hear C'', the same two did not hear C''', the same two and three more did not hear C<sup>iv</sup>. In the third group, by AC all forks were heard except for a gap of C''' in one case; by BC one case did not hear either C''' or C<sup>iv</sup>; the other forks were heard throughout. In the fourth group, by AC three did not hear C or C', two C'', one C'''; by BC one did not hear C''', four C<sup>iv</sup>. With mixed cases, therefore, as with otitis media catarrhalis chronica, no aid is to be expected in prognosis through the medium of the tuning-fork tests. The tests simply show the amount of obstruction to hearing, and whether this is slight or grave, the feasibility of the removal of the disability depends upon the removability of the cause or causes.

#### CONCLUSIONS.

I. Intensity or duration Rinné BC > AC or BC = AC always indicates some middle-ear disease, either alone or as a complication.

II. In any peripheral disease sufficient to produce any degree of deafness, intensity Rinné BC > AC or BC = AC will be found to exist if a low enough fork be used in the testing, providing the internal ear is normal or nearly so.

III. The duration of BC is increased over the normal in affections of the sound-conducting apparatus, except for the highest notes (C<sup>iv</sup> and over); the explanation of this exception existing in the fact that the sound-conducting apparatus is not concerned in the transmission of high notes (Bezold, Siebenmann).

IV. In affections of the sound-conducting apparatus, sounds of a low pitch are poorly heard by AC, while high-pitched sounds are relatively well perceived.

V. The higher up the scale of forks the intensity negative Rinné travels, the greater the degree of sound obstruction existing in the sound-conducting apparatus, as a rule.

VI. The writer believes the prolonged duration of BC in affections of the sound-conducting apparatus to be due to a combination of the resonant effect of occlusion, to the shutting out of outside conflicting sounds, and perhaps also to disturbed labyrinthine tension, but does not believe that the hyperæsthesia theory as advanced by Steinbuegge is at all tenable, except at the very inception of an acute inflammation. If increased tension be a cause, it should prolong the duration for high forks correspondingly with that for the low, as it does not seem reasonable to have anything other than a uniform disturbance throughout the scale in the duration of BC, from variations in tension of the labyrinthine fluid. Any irregular reactions in bone conduction should, it seems to the writer, be attributed to other pathological changes either in the labyrinth, the nerve trunk, or centre.

VII. Any profound or prolonged middle-ear affection ultimately affects the labyrinth secondarily.

VIII. If the duration of BC be curtailed to any extent, as compared with the normal or known abnormal, there is some internal ear disease, either alone or as a complication. The writer would lay stress upon the fact that in order to determine degrees of nerve deafness, testing only with the series of tuning-forks of middle register will almost invariably indicate the seat of the trouble by a diminished duration of BC for the C<sup>IV</sup> fork, which is also, but progressively less noticeably, present in those forks immediately lower, only excepting those cases giving gaps. This is confirmed by Gradenigo, who found diminution of hearing in lesion of the nerve trunk demonstrated by examination with forks of middle register.

IX. The intensity Rinné (comparative initial loudness of AC and BC) and Schwabach (absolute duration) tests when combined furnish much more valuable assistance than either the duration Rinné (comparative duration of AC and BC), or Weber in the diagnosis of ear troubles.

X. It is not necessary, when the entire series of tuning-forks is used, to put any arbitrary whisper limitation upon the reactions in determining the diagnosis.



XI. It is possible to have a higher fork heard  $BC > AC$  or  $BC = AC$ , either by intensity or duration, when the next lower fork is heard  $AC > BC$ .

XII. The tuning-fork tests give no certain help in prognosis as to the degree of improvement that may be hoped for, except that when in affections of the sound-conducting apparatus intensity negative Rinné has climbed up to the  $C^{IV}$  fork, not much, as a rule, can be hoped for through treatment.

XIII. Duration of  $BC$  becomes almost or quite normal, when normal conditions are restored.

XIV. The forks absolutely necessary to a diagnosis, where time is a consideration, are the  $C'$  fork, 32 — 64v., or Dench's 26 — 64v. clamped fork, to determine intensity Rinné and the  $C'''$  fork, 1024v., to determine absolute  $BC$ . The two combined give a pretty true idea of the ordinary conditions and the necessities.

XV. The writer desires to insist that in the thorough canvassing of the whole series of tuning-forks lies the great advantage that where one may easily be misled by any one fork, it is almost impossible not to gain valuable diagnostic points when the reactions throughout the scale are compared with the normal and known abnormal.

XVI. There are apparent exceptions to all the above conclusions, and it behooves the observer not to conclude therefore that the generalizations are of no value, but rather to inquire carefully into the exceptions with the hope of ultimately strengthening our knowledge of a difficult subject.

The writer has purposely in this article given the results only through the middle register, and does not wish even these to be considered to represent his crystallized opinion, as he is still pursuing experiments along the same line. They are only given out as a matter of observation. Investigations in regard to the upper and lower tone limit, Weber, and so forth, are reserved for a future communication, as is also further work in the direction of prognostic help.

### THREE FATAL CASES OF OTITIC INTRA-CRANIAL COMPLICATIONS.

By PROF. S. MOOS, HEIDELBERG.

Translated by GEO. L. MORGENTHAU, Chicago, Ill.

THE more numerous the reports of otitic intracranial complications the more certain becomes the interpretation of the symptoms, the diagnosis, and the treatment in a given case. From this point of view, I publish the following three cases which were observed at a time when operative brain surgery was in its infancy, at least in Germany.

CASE I.—Notable case of otitic thrombosis of lateral sinus. Death from pyo-septicemia after perforation of mastoid process.

Patient, lawyer, æt. fifty-four. Father and two brothers died of tuberculosis. Began treatment September 26, 1890. He maintains that, as far as he remembers, he has never been seriously ill (!) excepting a discharge from the left ear, dating from earliest childhood, for which he never consulted a physician. Aural discharge is said to have grown worse since September 17. On this day, it being hot weather, he took a walk in the woods, without a coat, in shirt sleeves. He claims to have caught cold on this occasion, to have felt uncomfortable afterwards, but without chills or fever. For the first time since the ear trouble began, he has pains in and behind the left ear since 3 days; they persist to-day, although not to a great extent nor continuously; without headache, or tinnitus, and without giddiness or nausea; appetite somewhat diminished; no constipation.

Present condition. Diffuse redness over left mastoid, slight enlargement, but little sensitive on pressure and percussion; in

middle of posterior wall of bony meatus, small granulations; drum-membrane entirely gone; labyrinthine mucous membrane appears thickened, after the layer of pus is removed by syringing, the fluid escaping by Eustachian tube. Hearing: voice understood at  $\frac{1}{4}$  metre, but also when both ears are plugged; watch and acoumeter, *nil*, by air and bone conduction. Tuning-fork of 8 octaves; patient states that, on the left side, he perceives only g 5, and by bone conduction only C (128 vibrations). Temperature, *normal*; pulse, 108.

September 27, 9 A.M.—Mastoid operated on with chisel. It appears sclerotic throughout. In process itself no trace of pus. Only on reaching antrum, caseous masses which flow abundantly from external meatus on irrigation. Injected fluid escapes partly by tube. Dressing of iodoform gauze. 2 stitches.

4.30 P.M.—Temperature 38.5; nearly uninterrupted sleep since operation.

9 P.M.—Temperature, 38.0.

28, 9 A.M.—38.0. Pulse, 84; very good night.

29, 9 A.M.—38.4. Pulse, 90; change of dressing; stitches taken out; but few hardened masses removed by irrigation; 6.30 P.M. and 8.30 P.M., 37.9.

During night 29—30 September great pain in region of left tragus. 30, 9 A.M.—37.6. Large abscess of tragus opens spontaneously. Now entirely free from pain. Feels well. 4.30 P.M.—Temperature, 37.1. 3.30 P.M.—36.5.

October 1—8 A.M. Temperature, 37.2; pulse, 90. Vomits breakfast. Profuse discharge from tragus abscess. Change of dressings; irrigation; escapes mostly by tube. Margins of wound gape, also where stitched. Iodoform gauze dressing. 3 P.M. and 6.30 P.M.—Temperature, 38.5; pulse, 100; very thirsty. Very quiet, good sleep during night October 1—2. Nevertheless, great lassitude in the morning. No appetite; temperature, 38.8; pulse, 100. Wound is very much softened, gangrenous. Iodoform gauze dressing. Condition unchanged till 5 P.M. Temperature, 39.5; pulse, 104. 30, P.M.—Temperature, 38.5. Night October 2—3, sleep again quiet and good.  $\frac{3}{x}$  8 A.M., temperature, 37.8; pulse, 108. Wound and dressing as lately. 9.30 A.M.; temperature, 38.8. Tongue much coated; complete loss of appetite; constipation (saline waters repeatedly given without result); much albumen in urine (persists till end). Great prostration. Champagne. 6 P.M.—Temperature, 37.8; pulse,

120; respiration, 54. Over whole lung, especially at upper two thirds, numerous fine and coarse râles; more fine râles with tympanitic resonance in upper two thirds; in lower third resonance is dull. After rectal injection copious passage. Infus. Ipecæ.

*October 4, 8 A.M.*—Rather quiet night; temperature, 39.9; pulse, 144; respiration, 48. Lungs same as yesterday. Somnolent. Cannot be roused by calling. Otherwise same condition. *4 P.M.*—38.5. Complete loss of consciousness. Stammers meaningless words. Only champagne is taken. From *4 P.M.* body began to swell. Death, *9.30 P.M.* Soon afterwards numerous ptechiæ on hands.

#### Autopsy by Professor Ernst:

Thrombic masses in transverse and semicircular sinus to jugular foramen; inferior petrosal sinus with beginning softening of thrombi. Dirty, brownish, cheesy appearance of thrombi. Hemorrhagic fibrinous pachymeningitis (layer of thin, discolored fibrin) in post. cranial cavity (on post. wall of petrous bone). Superior petrosal sinus is impervious just before entering transverse sinus; then sinus appears suddenly well filled, and continues so over petrous bone. The blood cannot be squeezed towards transverse sinus.

Old opacities and thickening of pia mater of convexity (in addition, numerous Pacchionian granulations). Anemia of brain. Multiple adhesions between dura mater and skull-cap, and dura and pia mater.

Atheroma of aorta and coronary arteries.

Old pleuritic adhesions on both sides; on the left, more extensive and firmer (without obliteration of entire pleural cavity). Multiple purulent, round, and wedge-shaped pneumonic foci; on the left, more at periphery; on the right, quite numerous also in central part of lung. Granular atrophy (chronic interstitial hepatitis) of liver.

Parenchymatous nephritis.

Organs in far advanced disintegration, with gas bubbles.

Stomach much dilated. Swelling of spleen. Obesity.

#### EXAMINATION OF PETROUS BONE.

About the middle of the posterior wall of the bony meatus several small granulations springing from circum-

scribed carious spot. Antrum without caseous masses; lining thick, bluish-red (post-mortem phenomenon?). Mucous membrane of labyrinthine wall of similar appearance. Drum-membrane and first two ossicles missing. Tympanic opening of tube very wide. Nowhere signs of caries which could have communicated the sinus thrombosis. Labyrinth not examined.

This case is notable in many respects:

1. On account of rapid onset of fever—8 hour following perforation of mastoid, not having been present before.

2. On account of the peculiar course of the fever, differing nearly entirely from the course of fever in infection from sinus thrombosis. Never a chill, nor, still less, rigor; and the greatest variation during the day was only  $2^{\circ}$ , even only  $1\frac{1}{2}^{\circ}$  on the final day.

3. On account of the disproportion between the comparatively low temperature and the great extension of the secondary affections in lung and kidneys.

4. On account of the absence of carious portions which might transmit the local affection to intra-cranial parts.

5. On account of the rapidly fatal course.

6. On account of the abscess of the tragus, which was evidently metastatic.

In forming the diagnosis, I did not recognize the inter-cranial mischief; I thought of miliary tuberculosis, being led to this, mainly, by the tubercular diathesis, the quickly appearing extensive pulmonary affections, as well as the albuminuria and the absence of clinical phenomena of pyemic fever.

The rapid onset of the fever after operation suggests that, considering the absence (as shown post-mortem) of a transmitting caries, perforation of the mastoid—rendered more difficult by the osteo-sclerosis—may have been the immediate cause of the fatal lateral sinus thrombosis; that, therefore, the dangers of the chisel operation are increased under certain conditions, in a similar manner as Galli, in his essay "On surgical operations from a clinician's point of view," expressed fears in regard to the brain. Probably, alcoholism was a predisposing factor in the production of the pyo-

septicemia which appeared shortly after the operation and ran such a rapid course. In order to avoid errors of diagnosis in similar cases, bacteriological examinations of either the blood or the secretions, or both, might be advisable.

Birch-Hirschfeld,<sup>1</sup> in 1893, drew attention to the presence of bacteria in the blood of pyemics. Gariré,<sup>2</sup> Von Eiselsberg,<sup>3</sup> and Korangi-Ferray,<sup>4</sup> were lately successful in demonstrating, positively, pus cocci.

It is known that we have quite a number of observations and proofs of the presence of cocci in the excretions of pyemics in urine,<sup>5</sup> in sweat,<sup>6</sup> in conjunctival secretions,<sup>7</sup> in exudations into joints,<sup>8</sup> and in the milk<sup>9</sup> of women suffering from puerperal sepsis.

CASE II.—This case deserves notice because of the co-existence of most of the otitic complications (facial paralysis, thrombo-phlebitis, cerebral abscess, and meningitis) as well as especially because of the possibility (demonstrated by the autopsy) of combining—if an operation had been undertaken—operative treatment of sinus thrombosis and of cerebellar abscess communicating with the sinus, with perforation of mastoid.

It is a case<sup>10</sup> of chronic left purulent otitis media; repeated exacerbations. Cholesteatoma in drum-cavity and mastoid; caries and polypi on its anterior wall, and caries on the anterior wall of the external auditory meatus. Facial paralysis. Most violent headaches. Repeated rigors. Death from paralysis of respiratory centres.

S. K., laborer, æt. thirty-seven. Received June 28, 1888.

Since infancy discharge from the left ear, with painful exacerbation of this disease and facial paralysis in 1885 while suffering

<sup>1</sup> *Med. Centralbl.*, 1873, No. 39.

<sup>2</sup> *Fortschritte der Medicin*, 1888, p. 166.

<sup>3</sup> *Wien. Med. Wochenschr.*, 1886, p. 135.

<sup>4</sup> *Wien. Med. Presse*, 1890, No. 37.

<sup>5</sup> Baumgarten's *Bact. Jahresberichte*.

<sup>6</sup> Brunner: *Berl. Klin. Wochenschr.*, 1891, No. 21. V. Eiselsberg: *ibid.* No. 23. Tizzoni: *l.c.*

<sup>7</sup> Passett: *Fortschr. Med.*, 1890, No. 2.

<sup>8</sup> Ehrlich: *Zeitschr. Klin. Med.*, 1881.

<sup>9</sup> Karlinski: *Wien. Med. Zeitschr.*, 1888, No. 28; Hochsinger: *Allg. Wien. Med. Ztg.*, 1888; Eschrich: *Fortschr. Med.*, 1890; Longard: *Arbeit. Path. Instit. Munich*, '90, vol. ii.

<sup>10</sup> See my essay on bacteriological diagnosis and prognosis of purulent middle ear diseases. *Deutsche Med. Wochenschr.*, 1888, No. 44.



from pulmonary catarrh, which kept him from work for six weeks. Mother died of phthisis; a sister of stomach disease; another of an acute abdominal trouble, after having undergone an operation for mastoid cholesteatoma in the aural clinic some years before. Five of his surviving brothers and sisters are healthy. Without evident cause, the aural disease which had persisted since 1885 but without pains, has grown much worse since four days; continuous pains in and behind the left ear, increased discharge, fever, loss of appetite, constipation, thirst, poor sleep, vertigo but no vomiting.

Present condition: Left mastoid swollen, somewhat reddened; painful spontaneously and on pressure. Violent headache.—External meatus filled with polypi, between which pus shows on slight pressure with probe. During this examination, rigor, Weber's test, with different tuning-forks, to right side. Hearing on left side, *nil*, excepting bone conduction for watch and acoumeter. Slight facial paralysis. Marked pallor. Temperature, 12 M., 38.3. Pulse, 60. Patient refusing any operation whatever, is therefore sent to the medical clinic with diagnosis of lateral sinus thrombosis (meningitis?). On being received, decided exacerbation of headache, great lassitude, nausea, no vomiting, tongue coated, pharynx angry. The rather narrow pupils react to light and on accommodation. Eyes move freely. On left side submaxillary glands somewhat swollen, fairly sensitive on pressure. Left facial paresis (uvula drawn a little to left side). Other cranial nerves intact (Left ear, see above). Thoracic and abdominal organs without apparent anomalies. Temperature, 40.3, pulse, 103, regular, rather strong. Tendon reflexes normal. Skin reflexes rather active. Motility and sensibility intact. Reaction of vaso-motor system hardly increased. Treatment: ice bag on head and behind left ear, which is cleared with boric acid solution. *Ac. muriat. dilut.* 1.5: 150.0. Calomel 0.3. June 29, 1888, A.M., temperature, 38.8, pulse, 114. Towards midnight patient complains of intolerable headache, cries out aloud, wants to jump from bed. Hypodermic of 0.015. Morphine brings rest and relief, also sleep. No convulsions, no gnashing of teeth. Left mastoid more sensitive; ear itself does not pain, has ceased entirely to discharge. Some vomiting after drinking milk.

3.30 P.M.—Temperature, 40.9; pulse, 88; rigor for 30 minutes; Very violent, paroxysmal headache. Morphine 0.01 subcutaneously relieves, but briefly. Consciousness somewhat obscured.

Pulse distinctly slower. Patient again rejects any operation, and is transferred to surgical clinic, where death sets in 30, A.M., with paralysis of respiratory centre.

*Clinical diagnosis:* Lateral sinus thrombosis. Localized meningitis.

*Anatomical diagnosis:* Basal purulent meningitis. Thrombosis of semicircular sinus, with perforation of its posterior wall. Caseous plug in sinus. Perforation above sinus, communication with putrid cerebellar abscess. Septic thrombus in bulb of jugular vein. Obliteration of left pleura. Compensatory emphysema of right lung. Acute enlargement of spleen.

POST-MORTEM EXAMINATION OF PETROUS BONE, WHICH  
COULD NOT BE DISSECTED BECAUSE REFERRED TO  
PATHOLOGICAL MUSEUM.

0.5 cm to the inside of the petro-squamous suture on the tegmen tympani an opening 2 mm large, is found; a probe can be pushed through it to a curious spot of the same size on the exterior of the mastoid. The posterior portion of the drum-cavity as well as the mastoid interior are filled with cholesteatomatous masses which protrude, partly, from the posterior wall of the bony auditory canal and are covered by the granulations recognized during life. A probe introduced through this carious posterior wall in the direction towards the sinus reaches the perforation in the sinus wall, described in the above report, through a small carious opening in the sulcus. The anterior wall, too, of the external auditory canal is carious.

DETAILED DESCRIPTION OF CEREBRUM, ETC., ACCORDING  
TO THE POST-MORTEM REPORT OF PROF. ARNOLD.

Thick skull, broad diploë, deep vessel grooves. Internal adhesions of dura over parietal bones; much fluid blood and soft fresh clots in longitudinal sinus. No thrombi. Dura, delicate, transparent; visceral surface moist and glistening. On uncovering left hemisphere, collection of pus is found along blood-vessels in the region of lowest cerebral convolution. Corresponding parts on right side free. Pial veins well filled. Much pus around chiasma and optic nerve,

especially on left side. On severing tentorium from its attachment to petrous bone, very fetid discharge. Both transverse sinuses contain fluid blood, and fresh dark red clots. No thrombi. Same conditions in right semicircular sinus. Left semicircular sinus is thrombosed and divided into two nearly equal parts, both of which are filled with soft, either discolored or dark red, thrombi. In the middle, a caseous mass of the size of a split pea; corresponding portion of posterior sinus wall is missing. A probe sinks from here into petrous bone. Fossæ Sylvii largely closed by purulent exudation. Caseous spots on crura cerebri, chiasma, and superior aspect of cerebellum; in sinus, immediately under attachment of tentorium to petrous bone, round macerated opening in dura which adheres to neighboring portion. On loosening this adhesion, fetid pus oozes from cerebellum. In left cerebellar hemisphere a putrid abscess 4 cm long and 3 cm broad, in hemorrhagic area. Right cerebellar hemisphere intact. At base of brain, grayish dirty discoloration of cortex; flattening of gyri, especially on left side, although but little exudation on convexity.

CASE 3.—This case deserves notice on account of the two cerebral abscesses remaining absolutely latent during life until a week before death, as well as of the fact that one abscess was situated in the cerebrum of the diseased side while the other was in the cerebellum of the healthy side. Nevertheless, there were only phenomena due to intra-cranial pressure present during life. For notes on everything which I did not observe personally in this case, I am indebted to the patient's father-in-law, who, himself a physician, attended the patient during the critical period.

Patient, a Russian merchant of thirty-five, had scarlatina in his childhood, with resulting purulent inflammation of the left middle ear. Pains were not present till a week ago; and the discharge from the ear has, apparently, ceased altogether lately. Besides the aural disease, patient is suffering from "enlargement of the heart," and for that reason came to Nauheim from Russia to take warm gas baths. The trip was made by the otherwise healthy and well-built patient without the least signs of discomfort. The treatment by baths begun two weeks ago is apparently borne well.

A week before death he had great pains in the depths of the right ear, and most violent headache. These symptoms are said to have been the only notable one till two days ago; there was neither fever, nor vomiting, nor giddiness, nor impairment of consciousness, but insomnia, which was ascribed to the pains; no disturbance in the course of any cranial nerve or of motility; no pupillary change. Two days before death "*rigor*," with pulse 36. Three hours before death "*rigor*," with pulse 136. Immediately after this I saw the patient. He still retained consciousness enough to assist in the examination of the auditory organ. Healthy left drum-membrane. The right was thickened and reddened in the posterior half, the anterior half was missing; within perforation inspissated whitish-yellowish masses. No discharge in external canal. Three hours later death resulted with intermitting respiration; loss of consciousness only in the final hour.

*Autopsy:* The brain was sent to me two days after death; but as it was already softened, I can only make the following statements as reliable: In the medulla of the right cerebral hemisphere there was an abscess of the size of a hen's egg, lined by a smooth, fairly vascularized membrane  $\frac{1}{2}$  mm thick; in the left cerebral hemisphere an abscess about as large as a walnut, without abscess membrane. The patient's father-in-law states there was meningitis basilaris. The genesis of the abscess found in the left cerebellar hemisphere cannot be explained. Should it be ascribed to metastasis in consideration of the decided rigors, which occur so rarely with cerebral abscesses?

#### EXAMINATION OF PETROUS BONE.

Nothing worthy of note in external meatus. Defect in anterior half of drum-membrane is filled with dry, yellowish, inspissated masses. Posterior half reddened and thickened, without pus layer. Mucous membrane of drum-cavity also thickened and reddened, only in posterior portion some purulent infiltration. Above malleo-incudal joint pin-head caries. Dura above and adjoining, of bluish discoloration and perforated twice. I do not dare decide if the use of warm gas baths contributed to the fatal exacerbation of the ear trouble.

## BILATERAL HÆMATOMA OF THE LOBULE.

BY DR. B. ALEX. RANDALL, PHILADELPHIA.

THE following case seems so unusual that even in its incomplete form it is worthy of publication:

Florence M., aged fifteen, of Irish parentage, was referred to me at the Ear Dispensary of the Children's Hospital on November 28th, by Dr. Walter J. Freeman, under whose treatment she had been for her rhinitis. Each auricle presented a soft fluctuating tumor of purplish-red color at the posterior attachment of the lobule—the larger one on the left being of the size of a small chestnut. Question elicited that the ears had been pierced for earrings four weeks before; but no trouble had been experienced until a week previous, when in an epileptic fit, such as she not rarely suffers from, strong traction had been made upon the lobules or on the rings worn in them, as a measure of resuscitation. The swellings had appeared painlessly in a few hours and remained unchanged except for some decrease and irregular shrinkage on the right. The ring-punctures were empty except for partial closing by slight plugs of epidermis; they were uninfamed and lay wholly external to the swellings and unrelated to them. The tumors were almost free from tenderness, and palpation gave a peculiar boggy feel as if from contained granulations. Incision was made on each side with little pain, giving exit to dark blood with no sign of pus; and the cavities were found to be partly filled with granulations and to extend to the slightly bared lower end of the auricular cartilage. Each was lightly curetted and vigorously rubbed with iodine glycerite, packed with iodoform-gauze and covered with a pressure bandage. This was substituted the next day by a light collodion dressing giving decided pressure—the

slightly blood-stained packing being left undisturbed. Two days later the packing was removed, showing the right cavity healing rapidly : the left was suppurating slightly, and, while better, was still unhealed when she withdrew herself from further observation three or four days later.

The usual absence of cartilage from the lobule would lead few to think of hæmatoma or perichondritis in connection with a swelling at this point, and the aspect of the tumefaction was such that many might have carelessly incised without recognition of the non-suppurative character of the lesion and have been surprised to evacuate nothing but blood. Should this method of resuscitating epileptics come into vogue as a substitute for some of those popularly approved, the lesion may become more common ; for the present its possibility at least should be recognized, with its relation in this case to an epileptiform disorder.



## A CASE OF BASAL FRACTURE.

By JOHN DUNN, M.D., RICHMOND, VA.

Farmer, aged fifty-six, was, in January 16, 1894, thrown from his wagon; a barrel of flour, rolling out of the wagon at the same time, struck him on the right temporal region. Unconsciousness for half an hour resulted. When the swelling in his face subsided he noticed his "face was twisted" and that he "had no feeling in that side of the face." In the latter part of February he consulted me about his right eye. The following condition of affairs was found to exist. *Complete paralysis of fifth, sixth, and seventh nerves of the right side.* There was no sensation in the skin of the face supplied by the fifth nerve. Neuro-paralytic keratitis had set in. The cornea was denuded of its superficial and of some of the deep layers for its whole surface, save a crescentic area, which accurately adjusted its outline to the part of the cornea covered by the upper lid, and a narrow rim adjoining the conjunctiva. Hypopyon was present. The conjunctiva was much swollen and inflamed, and the inferior cul-de-sac covered with a whitish sero-mucous exudate; there was no lachrymal flow. Conjunctiva, etc. insensitive. Ectropion. Eye drawn into inner canthus. Right nostril closed at the entrance by a sero-sanguineous exudate, from which the watery parts had evaporated, leaving a dry, firm, sticky plug for the nasal entrance. Removal of this and examination of the right nose showed it to be perfectly dry and free from secretion; its mucous membrane pale, and covered with a thin whitish film, which proved to be cast-off epithelial cells; mucous membrane absolutely insensitive, (various experiments were made to prove this). Degree of loss of smell, if any, could not be accurately determined, the other side being healthy. Usual symptoms of paralysis of 5th in the

mouth and pharynx. Paralysis of the facial nerve complete, as was also that of the sixth nerve. Patient, a farmer, remained under observation only four days, during which time cornea ruptured, and there was much increase of destruction of its substance. Drum normal. There was a slight diminution of the power of hearing in the right ear. The hearing was, however, good. Patient complained only slightly of noises in this ear. No discharge. No vertigo. The symptoms of which the patient complained most were stoppage of right nostril, and the disappearance of, at times, and his inability to locate, particles of food in his mouth. The right eye was not painful.

Patient was again seen July 6th. Condition practically unchanged. There had been a further destruction of the cornea, the remains of which and the iris were now grown together. Eye painful towards night. Hearing reduced to watch at one inch. Some complaint of noises in ear.

In looking for the location of an injury which could cause paralysis of the fifth, sixth, and seventh nerves, and these alone, we naturally seek the apex of the petrous part of the temporal bone, the portion internal to the entrance of the internal auditory canal, and superior to the carotid canal. The line of force applied to the temporal region was most likely directly inward. Were this so, there could result a fracture causing just the paralyses above mentioned. The line of fracture might be directly through the fossa for the Gasserian ganglion, might be so high up as to injure the seventh, while the eighth nerve only a short distance below might escape; the jamming of the fractured segment into the upper part of the cartilage filling the foramen lacerum anterior might have caused the injury to the sixth nerve as it passes forward in the interval between the apex of the petrous part of the temporal bone and the posterior clinoid process of the sphenoid. The patient's general health seemed to be in no way affected by the injury. He declined any treatment, inasmuch as relief could not be promised him. His condition six weeks after the injury is above described.

## A CASE OF OTITIS HEMORRHAGICA EXTERNA.

By JOHN DUNN, M.D., RICHMOND, VA.

On February 13, 1894, at six in the afternoon, Mr. M., aged thirty, was not conscious of any unusual sensations in his ears. Some time between six and 11 P.M. his left ear became the seat of pain, which increased rapidly in severity until at 1 A.M., when "something burst and a lot of blood and stuff ran from my ear." The pain had become unendurable. Following this discharge the pain ceased, and the ear was only the seat of a dull, unpleasant sensation. When I saw Mr. M., February 14th, at 11 A.M., I found more or less semifluid blood and serum in the external canal, A.S.; when this had been removed with a cottoned probe and the canal cleansed, it could be seen that the skin over the bony part of the canal and over the drum was the seat of a severe inflammation, which had resulted in the formation of numerous small hemorrhages in the skin; these extravasations varied in size from a pin-point to a millimetre in diameter; they were irregularly placed. The drum-head was so swollen that the outlines of the malleus were not to be seen. The source of the bloody serum could not be made out; the seat, however, of the greatest number of the extravasations was in the upper posterior part of the canal near the drum-head. The hemorrhages were in the skin throughout the whole extent of the bony meatus. They did not extend into the skin covering the cartilaginous meatus. The skin in the bony meatus did not appear to be like that on the drum-head, swollen. Examination of the right ear revealed a drum-head normal in color, and save a slight retraction (a condition of long standing), normal in appearance. There was absolutely no sign of inflammatory disturbance visible. Mr. M. was told that the trouble in the left ear was, in all likelihood, confined to the outer skin of the drum-

head, and was not the evidence of middle-ear inflammation. At 4 P.M. the same afternoon Mr. M. returned to my office saying that the right ear was beginning to ache just as the left one had done. Examination revealed an acutely inflamed drum-head, whose entire surface was so swollen as to conceal the malleus the full length of the long process. The greater part of the swelling was, however, over the posterior segment of the drum; and the severest inflammatory appearances of the canal were in the upper posterior part adjacent the drum. Mr. M. was made to remain in his room. Treatment was pilocarpine and Rochelle salt, both of which acted well. The next morning there was a slight amount of bloody serum in the canal, while over the posterior segment of the drum was a blister of blood and serum occupying the upper half of the space between the long process and the posterior wall of the canal. There were some few hemorrhagic spots in the upper posterior wall of the canal. In this ear, however, they were not, as in A. S., throughout the whole extent of the bony meatus. On February 16th the contents of the blister had been so far absorbed that a creasing in its covering could be distinctly made out. On February 17th all of its contents had been absorbed. The handle of the malleus was visible its whole extent, and the drum-head showed nowhere evidences of being swollen, although it was congested its entire external surface. No more hemorrhages formed in the external canal. The trouble rapidly disappeared, so that a week later the external canals, including the drum-heads, were in appearance just as they had been prior to the inflammatory attack; nor was there any evidence of any improvement of hearing as the result of the trouble. Naturally there was considerable dulling of the perception of sounds during the time that the drum-heads were swollen.

In regard to the condition of the ears prior to the appearance of the hemorrhages:—Owing to neglect of the nose and naso-pharynx, in which at one time were immense adenoid hypertrophies, Mr. M. suffered from middle-ear catarrh, which had resulted in considerable retraction of both drum-heads, especially the left, and not a little impairment of hearing. Watch A. D.  $\frac{1}{2}$ ; A. S.  $\frac{1}{10}$ . There has been, however, no demonstrable diminution of the hearing power within the past two years. Nor was there just prior to the inflammation of the external canals above described any

acute trouble with the middle ears to serve as a forerunner of such an attack. Gruber is not inclined to look upon "Otitis externa hemorrhagica" as a distinct disorder, and his description of the affection (*Diseases of the Ear*, p. 239) is not as accurate as the history of a case such as the one reported above seems to demand. Politzer, *Ohrenheilkunde*, s. 147, describes very fully this form of inflammation of the external ear. The above case differs from the usual form in that the inflammatory process was most severe on the drum-head and upper posterior part of external canal. Again, Politzer says the "der Höhepunkt dieser Entzündungsform ist in der Regel am dritten Tage überschritten." In the above case the height of the inflammatory attack, which I consider to be the rupture of the vesicles, was reached within twelve hours from the time the patient became aware of unpleasant sensations in his ears. The fact that first one ear and then the other within twenty-four hours became the seat of similar inflammatory attacks is worthy of notice. No cause for these attacks could be found, other than going in and out of an overheated committee room in raw, cold weather.

## INVESTIGATIONS CONCERNING THE AVERAGE HEARING POWER OF THE AGED.

BY PROF. F. BEZOLD, MUNICH.

Translated by Dr. S. E. ALLEN, Cincinnati.

*(With three charts in the text.)*

THE investigations which I desire to report here were begun seven years ago, simultaneously with my school examinations.

The hearing of the inmates of the Infirmary in the suburb Haidhausen was tested, in the same manner as in the school investigations, the doors of this institution being kindly opened to me by the physician in charge, Dr. Schöner. The number of those who had passed the fiftieth year, and whose condition in other respects allowed of an examination, was too few to permit a statistical compilation. Later, our hospital director, V. Ziemssen, gave me the opportunity of examining old people coming to the hospital for other affections. I was thus enabled to make up to one hundred the number of individuals examined. This number is of course still too small to allow statistical conclusions to be drawn, trustworthy in every respect. Still the results will be given in what follows.

Besides the fact that this number (200 ears) is relatively small, it must also be borne in mind that the conclusions cannot be unqualifiedly applied to all persons above fifty years of age. For here exclusively the lower classes were examined, and these in reference to their hearing are subjected during the course of their lives to a much larger number of momentary as well as lasting injuries, than those better situated. The testing, naturally, must be by the simplest, the easiest to make and to control, and the least annoying methods.



With every individual, each ear was isolated and its hearing distance for whispering and conversation tested. All was done under such precautions as were used in my school examinations. (These rules and precautions are to be found in the work referred to.)<sup>1</sup> The space at my command, the wards of the infirmary and hospital, made it possible to examine the great majority at a distance of at least 10 metres. As a rule, this distance was more than sufficiently great, as the results below show.

As in the school examinations, the drum membrane was inspected in all cases, and alterations in color and curvature or defects noted. Where cerumen hindered the examination or obstructed the meatus, it was for the most part removed. An examination of the nose and naso-pharynx had to be dispensed with.

As to tuning-fork tests, in the great majority of the cases, the Schwabach and Rinne experiments could be conducted with an A<sup>1</sup> fork, and partly also with an A fork. The duration of bone and air conduction for these forks, as well as the results of the Rinne experiment are published in my *Statistical Results Concerning the Diagnostic Applicability of the Rinne Experiment*,<sup>2</sup> to which I refer in this connection. On account of the slight intelligence of those examined, we were barred from attempting to determine the upper tone limit, or tones the perception of which happened to be wanting. Such determinations are made by using a continuous series of tones.<sup>3</sup>

With reference to the contraction which the scale experiences in old age at its upper and lower limit, I have conducted a greater series of examinations on private patients, belonging to the better classes, and having therefore more interest in the question. These results appeared in the *Zeitschrift für Ohrenheilkunde*.<sup>4</sup>

The acuteness of hearing for the scale as a whole, which we determined quickest and most completely with the whispering voice, or in case that is not understood, with the ordinary conversational tone, was found to be encroached

<sup>1</sup> *Zeitsch. für Ohrenh.*, xv.

<sup>2</sup> *Zeitsch. f. Ohrenh.*, Bd. xvii.

<sup>3</sup> A continuous series of tones as a means of testing hearing, *Muench. Med. Wochenschrift*, No. 38, 1892.

<sup>4</sup> *Zeitsch. f. Ohrenh.*, Bd., xxiii., S. 254.

CHART I.

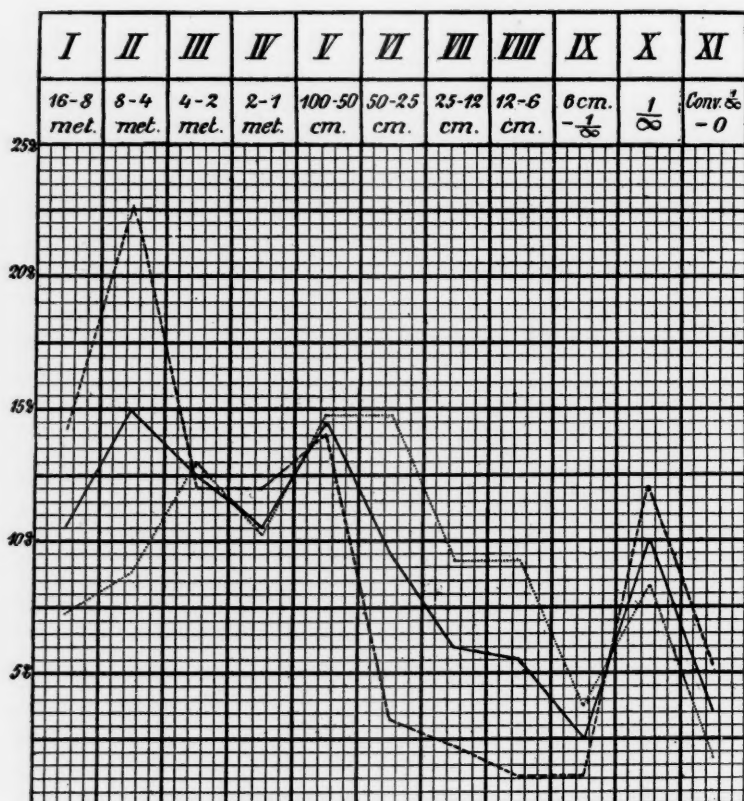


CHART II.

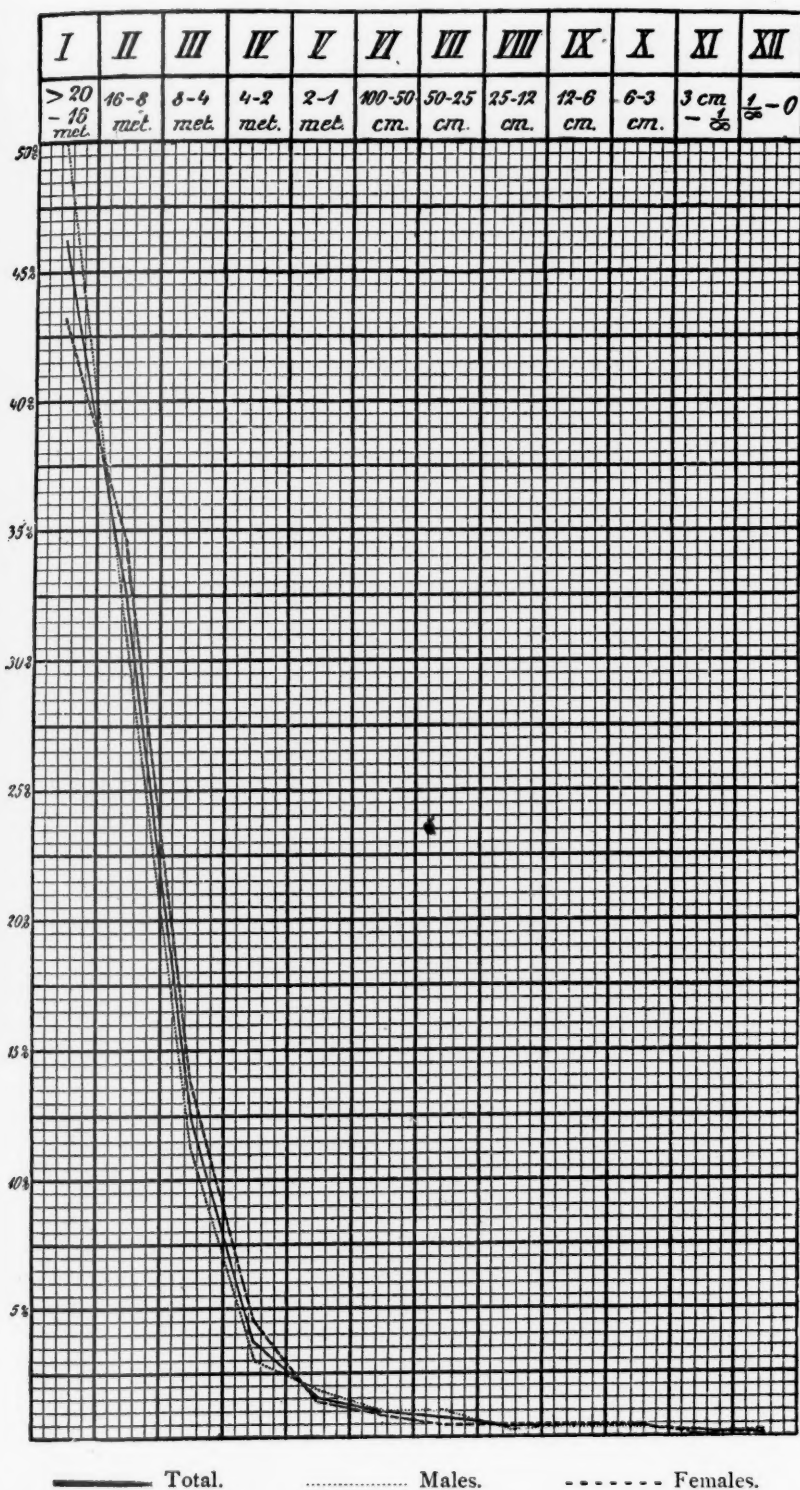
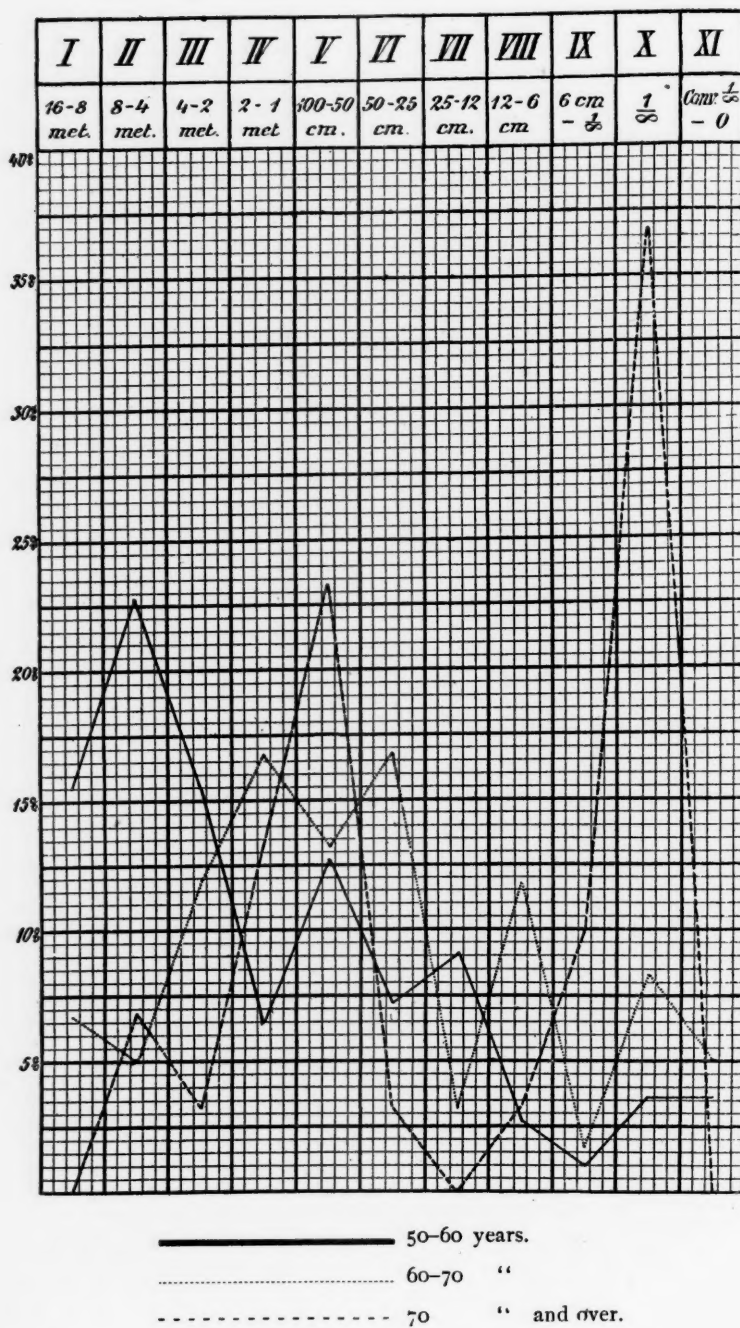


CHART III.



upon to a marked degree in most of those of the age and class examined (from fifty years on).

The pronounced difference between the acuteness of hearing of the young and the old can be seen at a glance if we represent graphically the numerical differences found. This is done in Charts I and II.

The average acuteness was found distributed among the different decades as follows :

In 110 ears of those between fifty and sixty years whispering was perceived :

At 16 to 8 m	by 17 or 15.5 %
At 8 to 4 m	by 25 or 22.7 %
At 4 to 2 m	by 17 or 15.5 %
At 2 to 1 m	by 7 or 6.4 %
At 100 to 50 c	by 14 or 12.7 %
At 50 to 25 c	by 8 or 7.3 %
At 25 to 12 c	by 10 or 9.1 %
At 12 to 6 c	by 3 or 2.7 %
At 6 to $\frac{1}{\infty}$	by 1 or 0.9 %
Whispering uncertain ( $\frac{1}{\infty}$ )	by 4 or 3.6 %
Conversation uncertain (— 0)	by 4 or 3.6 %

In sixty ears of those between sixty and seventy years, whispering was perceived :

At 16 to 8 m	by 4 or 6.7 %
At 8 to 4 m	by 3 or 5.0 %
At 4 to 2 m	by 7 or 11.7 %
At 2 to 1 m	by 10 or 16.7 %
At 100 to 50 c	by 8 or 13.3 %
At 50 to 25 c	by 10 or 16.7 %
At 25 to 12 c	by 2 or 3.3 %
At 12 to 6 c	by 7 or 11.7 %
At 6 to $\frac{1}{\infty}$	by 1 or 1.7 %
Whispering uncertain	by 5 or 8.3 %
Conversation uncertain	by 3 or 5.0 %

And finally in thirty ears of those seventy years and older :

At 16 to 8 m	by 0 or 0.7 %
At 8 to 4	by 2 or 6.7 %
At 4 to 2	by 1 or 3.3 %
At 2 to 1	by 4 or 13.3 %
At 100 to 50 c	by 7 or 23.3 %
At 50 to 25 c	by 1 or 3.3 %
At 25 to 12 c	by 0 or 0 %
At 12 to 6 c	by 1 or 3.3 %
At 6 to $\frac{1}{\infty}$	by 3 or 10.0 %
Whispering uncertain	by 11 or 36.7 %
Conversation uncertain	by 0 or 0 %



In Chart III the hearing distances of each of these three different periods are graphically represented and placed together for comparison. It was to be expected that here the influence of age would show most plainly, and this is actually the case. Although the three curves, especially those for the second and third decades, have a rather irregular course, still, on the curves of all three decades, culminating points stand out with such distinctness that we cannot be in doubt as to the distribution of the deafness in the individual periods.

The irregularity of the curves would certainly have been less had it been possible to examine more individuals.

That which is characteristic of this distribution lies in this, namely: for each decade there is a different hearing distance under which the largest number of those examined come (corresponding to the culminating points above referred to). Among the 3836 ears of the school children, 46.5 per per cent. perceived whispering at over 16 *m*. From this height the curve falls, quickly at first, and then successively slower, till those ears are reached by which the perception of whispering is uncertain. With those of from thirty to sixty years the curve begins with a percentage of 15.5 for those hearing at a distance of from 16 to 8 *m*. The proportionally greatest number of those at this age (22.7 per cent.) had a hearing distance of from 8 to 4 *m* for whispering. From this point the curve runs unevenly downward, without again reaching a second elevation of note. Among those between sixty and seventy only 6.7 per cent. hear at a distance of from 16 to 8 *m*, and only 5 per cent. at a distance of from 8 to 4 *m*. For this period (sixty-seventy) the most marked elevation of the curve occurs at the distance-periods 2 to 1 *m* and 50 to 25 *c*. From here on we have an irregular descent. Among those seventy and above we find none with a hearing distance of 16 to 8 *m*. On the curve representing this class there appear two elevations, somewhat apart, the one, representing 23.3 per cent. at the distance-period 1 to  $\frac{1}{2}$  *m*, the other, at the distance period  $\frac{1}{8}$ . (As in the school examinations,  $\frac{1}{8}$  is taken to represent an uncertain perception for whispering, that is to say, a perception of only a portion of the numbers whispered.)



*In the decades following that from the fiftieth to the sixtieth year there is therefore not only a successive decrease in the number of those with nearly normal hearing, but there is also a successive increase in the degree of the deafness.*

This last appears plainly in Chart III from the movement of the high points of the successive decades to the right.

Let us return to Chart I. On the solid line, representing the total for both sexes, the high point is transferred from the limit of normal hearing to a point indicating a hearing distance of from 8 to 4 *m*. From here it sinks both toward the right and left. In the downward course to the right we find two marked elevations, the first at 100 to 50 *c*, nearly reaching the culminating point again, and the second at  $\frac{1}{100}$ , reaching nearly one third of the height of the second elevation.

It devolves upon us now to seek an explanation for both of these deviations from an even downward course of the curve which, as seen in Chart II, takes place in youth.

A little consideration shows that the way the distance-periods (16 — 8 *m*, 8 — 4 *m*, etc.) are taken is responsible for the second elevation at  $\frac{1}{100}$ . The scale is divided evenly from the ordinate I, representing a distance of 16 to 8 *m*, to ordinate IX, representing a distance of 6 *c* to  $\frac{1}{100}$ , as each succeeding division is one half of the preceding. At ordinate X, however, this relation becomes changed, this period embracing all those who do not perfectly understand whispered numbers close to the ear. Individuals are put into this class if they fail to understand a single number, as well as when they can understand but one of all those experimented with. This is a scope of considerable magnitude, as is easily shown if we experiment with conversational tones instead of whispering. A portion of those placed in this division could understand the former at a distance of 2 *m* and farther, while others at but a distance of from 6 *c* to  $\frac{1}{100}$ . In the last period (conversation at  $\frac{1}{100}$  to O) only those are put who perceive conversational tones uncertainly or not at all. If those under ordinate X ( $\frac{1}{100}$ ) had been tested with conversation they would have been distributed under the preceding six consecutive ordinates, and the elevation at this point been avoided. That this solution is correct follows from the fact

that, although in different degrees, in each period of life and with each sex the elevation appears without exception. In the case of the children; this class came but little into consideration, because the number of those markedly deaf is here still small, and those so affected in both ears are sent not to the schools, but to deaf and dumb institutes. There was one individual deaf and dumb from childhood among the one hundred adults examined.

In order to reach an understanding of the second elevation which occurs on the curve representing the total for both sexes (Chart I), we must examine the sexes separately.

The sexes are not represented separately by the curves given in my school examinations, but here in Chart II, I have separated them. The three curves shown in this chart represent the different hearing distances of the boys, the girls, and both together, respectively. These curves are therefore directly comparable with those representing the two sexes and total of the old people.

*With the old people there is a marked difference between the sexes, while in the school children the males, females, and total have curves falling almost together, all three having a remarkably similar course. The curve for the women reaches its high point at 8 to 4 m, from there on it sinks toward the right, showing in its course two elevations, one at 100 to 50 c, and the other at  $\frac{1}{100}$ . The curve for the men, on the other hand, reaches its high point at 100-50 c, and remains at this height to 25 c, and then sinks slower and generally not so considerably as that of the women. At  $\frac{1}{100}$  it has once more a slight elevation. This can be thus expressed in words: The number of men who perceived whispering at 1 m to  $\frac{1}{100}$  is relatively much larger than the number of women.*

We must seek a cause for this reduction in acuteness just at this level, because at the third elevation at  $\frac{1}{100}$ , also representing those markedly deaf, more women than men are found.

The explanation is to be sought in the many hurtful influences of their calling, noisy occupations, detonations, trauma, alcohol, nicotine, etc. Women are not entirely removed from these hurtful influences, as the elevation at

the same period (100 to 50c) shows, but they are exposed to a much less degree than the men.

Conversely, we can draw the conclusion from the male curve, *that it is chiefly a moderate grade of deafness which is produced by the injurious influences above mentioned.*

The first elevation, in the curve representing the total, corresponds to those having, relative to their age, normal hearing. A separation into the sexes shows that this is due exclusively to the women, and that we must consider the smaller number of men as being distributed between the ordinates V and IX. These ordinates represent a hearing distance of from 1 m to  $\frac{1}{\infty}$ .

It is also of interest to consider the curves on Chart II. Here we see that in youth the male ear is somewhat better than the female, as is evident from the greater initial elevation of the male curve. This difference can hardly be considered accidental because of the large number of children examined, and the otherwise similar course of the curves. *The female sex in old age also shows itself to be less resistant, at least toward those influences which cause a high grade of deafness.* This is seen in Chart I, at the third elevation at  $\frac{1}{\infty}$ .

We come now to the discussion of the objective and functional appearances of the ear in the aged. It seems most fitting to classify the different hearing powers into three groups, corresponding to the three elevations seen on the curve representing the total for both sexes, Chart I. The first group embraces those hearing at a distance of from 16 to 1 M. The second, those with a hearing distance 1 M. to  $\frac{1}{\infty}$ . The third  $\frac{1}{\infty}$  to 0.

The first group includes 97 or 48.5 %.

The second 76 or 38.0 %.

The third 27 or 13.5 %.

It is not to be wondered at if we find a number of alterations on the drum among the first group.

It is well known what great variations from the normal can exist without a greater deafness resulting therefrom. These middle ear changes are of little consequence, because the disturbances most active in producing deafness in old people are to be sought the other side of the middle ear.

The results of objective and functional examinations of these three groups, given in percentages, are as shown in Table IV.

*Table IV.*—Showing the results in percentages of the objective and functional examinations :

Hearing distances for whispering, determining the three groups.		Percentages found.		
		16 to 1 m	1 m to $\frac{1}{8}$ m	$\frac{1}{8}$ m to 0.
Meatus .....	{ Exostoses Cerumen	2.1 14.4	22.4	11.1
Drum reflexes	Normal reflex { Normally placed Absent Pushed toward periphery	81.4 5.2 0	80.3 10.5 0	51.9 7.4 3.7
		0	1.3	0
		35.2 35.2	30.3 42.1	51.9 25.9
	Reflex over short process	0	1.3	0
	Sulcus { Visible reflex { Concealed	35.2 35.2	30.3 42.1	51.9 25.9
Coloranomalies of drum...	Diffuse opacity	16.5	25.0	14.8
	Circumscribed opacities	23.7	26.3	29.6
	Posterior stripe-opacities	21.6	13.2	7.4
	Calcifications	3.1	1.3	7.4
Form anomalies of drum.....	Posterior fold	6.2	9.2	7.0
	Handle of hammer or short process prominent	1.0	0	0.5
	Scars	5.2	7.9	8.0
Perforations of drum.....	{ With otorrhœa	0	2.6	7.4
	{ Without otorrhœa	0	2.6	3.7
Number of those tested as to bone conduction		100	100	100
Bone conduction tested with fork a' on the head	{ Lengthened Not shortened Shortened O	10.3	12.2	17.6
		48.5	53.1	5.9
		41.2	34.8	17.6
		0	0	58.8
Rinné experiment with tuning-fork a'.....	{ Positive, 15 seconds or more Positive, under 15 seconds $\pm$ 0 Negative	75.7	54.9	11.1
		24.3	35.3	11.1
		0	5.9	22.2
		0	3.9	55.6

These percentages become of interest if we compare them with the percentages, obtained in exactly the same manner, in my school investigations.

Obstructing cerumen masses were found among the aged in 7.5%, and twice as frequently among the women as the men, while among the school children in but 2.6%. This is in keeping with clinical experience.

The triangular reflex at the umbo occurred about as often among the old as among the children, namely, in 77.0%, as contrasted with 77.9%. The complete absence of the reflex existed in 7.5% of the aged, as against 4.1% of the children. The more frequent absence of the reflex among the old is probably due to a loss of smoothness of the epidermis of the drum.

Retractions of the drum, to which are reckoned the formation of the posterior fold, the broadening out of the handle, a transference of the normal reflex toward the periphery, and the formation of a reflex over and behind the short process, occur with the following frequency among the old and children.

	IN CHILDREN.	IN OLD PERSONS.
Posterior fold.	7.4 %	7.0 %
Hammer handle broadened, or short process prominent.	2.3 %	0.5 %
Normal reflex pushed toward periphery.	5.0 %	0.5 %
Reflex over short process.	0.9 %	0.5 %
Reflex behind short process.	3.4 %	0.

These figures do but confirm the clinical experience *that obstruction of the Eustachian tube, by which these anomalies of form are caused, is an affection especially of childhood.*

Quite other conditions of frequency existed for those alterations of the drum caused by middle-ear inflammatory processes. There were found namely:

	AMONG THE CHILDREN.	AMONG THE OLD.
Diffuse cloudiness of drum	in 2.1 %	in 18.5 %
Circumscribed opacities	" 12.7 %	" 25.5 %
Posterior stripe opacities	" 4.4 %	" 16.5 %
Calcification	" 1.5 %	" 3.0 %
Scars	" 1.9 %	" 8.0 %
Perforations	" 1.0 %	" 2.0 %
Perforations } with otorrhœa	" 1.0 %	" 1.5 %
Perforations } without "	" 1.0 %	" 1.5 %

The influence which these opacities had on the hearing is seen in Table IV, which shows, for scars and perforations, with or without existing otorrhœa, a regular increase in percentage with the increasing deafness. Perforations are not found at all in the first column among the relatively good hearing.

The important evidence furnished by this tabulation as to the cause of deafness in old age is *that the different sequelæ of former inflammatory processes are found in a much greater number from the fiftieth year on*. That these alterations can be made answerable only in part for the disturbances in hearing is evident from their frequent occurrence together with relatively good hearing.

The results of the examinations with regard to bone conduction do not admit the drawing of many conclusions. So much is evident, namely, *that in age the middle-ear affections are less frequent as compared to inner-ear troubles*. Taking those of the different hearing distances together, we find an excess of shortening over lengthening, and among the markedly deaf even a total absence of bone conduction in 58.8%.

Among the sixty, with a reduction of hearing distance to 1 m and less, who were examined as to the Rinné experiment, there were found :

29	with Rinné	+	15 seconds or more,
19	"	"	+, under 15 seconds,
5	"	"	+ O.
7	"	"	negative, that is to say with bone conduction longer than air conduction.

In all cases where the air conduction exceeds that of the bone by 15 seconds or more, we are justified in excluding any essential affection of the wave-conducting apparatus. An exception to this occurs only in acute middle-ear affections, and none such were present. A decidedly positive Rinné leads us safely to the inner-ear; a shortening or negative result in itself does not allow a safe conclusion when the difference in hearing power on the two sides is great.



One result of these Rinné experiments deserves to be put forward, namely: The normal duration of the Rinné experiment, found in youthful individuals to be 30 seconds for my fork a', was but exceptionally exceeded. Once it was 31 and once 32 seconds. The conclusion can be drawn *that also in old age, bone conduction in itself does not experience a reduction, but sinks proportionally with the lessening of the hearing distance.* This appears in testing the aged by air conduction with the tuning-fork, watch, speech, etc.

## THE PRESBYCUSIC LAW.

BY DR. H. ZWAARDEMAKER, UTRECHT.

Translated by DR. S. E. ALLEN, Cincinnati.

(With Plates II., III., and IV., Vol. XXIV., German Edition.)

I N 1890 I was able to determine, by means of the Galton whistle and sounding rods, that the compass of our hearing experienced an important contraction with advancing age. This manifestation begins in youth, and becomes so marked in old age as to be disclosed by the crudest examination. This loss of certain border tones, and the weakening of those immediately following, influences in no slight manner the understanding of speech and the mode and way in which musical tones are perceived. It is therefore probable that in it lies the chief cause of presbycusis. At any rate, the presbycusis is very sharply defined by the contraction of the field of audition, and has even become capable of measurement. I have shown in a former paper<sup>1</sup> that there exists such a contraction, not only of the upper tone limit, but also of the lower. In 1892, in these ARCHIVES, the presbycusic law received a welcome confirmation from a highly honored source. Professor Bezold took the pains to test my observations on one hundred and ninety nearly normal ears, and to compile the results in a couple of good tables. In some respects, however, these numbers differ from mine, and I shall take the liberty of giving, in a form

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<sup>1</sup> "De Omvang van het gehoor als analagon van het gezichtsveld." *Need Tijdschr. voor Geneeskunde*, 1892, Bd. i., bl. 502.

similar to Bezold's, the data collected by me, so as to permit a comparison.

Since the beginning of 1890 I have determined, with the greatest care, the upper limit in 219 perfectly normal ears. All these persons had a hearing distance for whispering of at least eight metres (the size of the room in which, in the beginning, my observations were made). Later on, a room ten metres in length was obtained, and then this latter distance required as a guarantee of normal acuteness. Even from among those most advanced in age, no one was taken who could not stand this test. In addition, an exact otoscopic and rhinoscopic examination was made. *All these 219 ears can therefore be considered absolutely normal.*

In the accompanying table the numbers are arranged according to Bezold.

As is evident from the table, the compass of our hearing experiences a continuous contraction from earliest youth to the most advanced age. This contraction takes place unusually regularly, for the mean for each group is:

Under 10th year.....	1.22
From 10th to 20th year.....	1.39
“ 20th “ 30th “ .....	1.39
“ 30th “ 40th “ .....	1.58
“ 40th “ 50th “ .....	2.23
“ 50th “ 60th “ .....	2.93
Over 60 years.....	3.03

The regularity is so great that it would be worth while to construct a curve, which would give the course of the contraction better than mean values do. If, however, this more exact delineation is to have permanent and general value, not the numbers on the whistle, but the heights of the tones to which they correspond, must be taken as a basis. Formerly I tried to accomplish this conversion by incomplete methods. To this end I made some approximate estimations in the *Archiv f. Ohrenheil.*, Bd. xxxii., S. 53. With the aid of my honored friend and former colleague, Dr. J. D. van der Plaats, I was able to better the methods, in so far that I can now convert quite accurately the scale of my

whistle into musical intervals. At another time I hope to make a more extensive communication concerning this. Here I shall give but the principle of the method, so as not to interrupt the train of thought too much.

If an organ pipe is blown under constant pressure, the nodes and wave crests occur at certain places, determined by the length of the pipe and the pressure. The positions of the same are not altered when different gases are employed. In the known formula,  $\eta = \frac{v}{\lambda}$  (where  $\eta$  = the number of vibrations,  $v$  = the velocity of the sound, and  $\lambda$  = the wave length),  $\lambda$  has an unchangeable value. One is therefore justified in forming a proportion between the number of vibrations and the velocity, thus:  $\eta : \eta' :: v : v'$ .

I took for my experiments two gases, everywhere at hand, ordinary air and illuminating gas. This latter had in Utrecht at the time of my experiments a sp. gr. of 0.39. According to the laws of physics (vel. of sound in air and gas),  $\eta : \eta' :: 1 : 1.54$ . That is to say the pitch of the two tones which one gets on sounding an organ pipe first with air and then with gas differs by an interval of one-fifth. Fundamental tone and fifth are as one 1 : 1.5, which is about the same ratio as accidentally found between the two tones produced by air and gas respectively.

This permits the gauging of the Galton whistle. If  $\eta'$  is the fundamental tone of a person, the organ pipe which gives this tone with gas, gives with air a tone  $\eta$ , a fifth lower, for  $\eta : \eta' :: 1 : 1.54$ . This last tone ( $\eta'$ ) can also be produced by sounding a shorter pipe with air. In other words we get two lengths of pipe whose tones  $\eta$  and  $\eta'$  differ by an interval of a fifth. If we make several such determinations on persons of different ages, we get a number of pairs of pipe lengths. (Instead of gas and air we can use other gases and thus determine the much varied intervals.) A curve can then be constructed which gives the increase in height of tone relative to the shortening of the pipe.

For the Galton whistle with which I made my experiments, the curve has the form shown in Plate II.

We have determined up to now, the form of the curve alone, and not the situation of the same in the system of

co-ordinates. To get at this, we need yet the absolute pitch of some one point on the curve. If we obtain this the situation of the other points follows. The fundamental tone for childhood is at 1.25 on my whistle, and comparisons with sounding rods show that this same note is produced by a rod sounding  $e^7$ . We can therefore put 1.25 of the whistle equal to  $e^7$ . The curve then teaches us the numbers on the whistle that corresponds to the second, third, fourth, fifth, etc. We find :

Taking  $e^7 = 1.25$ .

$d\sharp^7 = 1.5$	$a\flat^6 = 3.1$	$f^6 = 6.1$	$c^6 = 9.3$
$d^7 = 1.8$	$a^6 = 3.7$	$e^6 = 6.8$	$b^6 = 10.0$
$c\sharp^7 = 2.1$	$g\sharp^6 = 4.3$	$d\sharp^6 = 7.4$	$a\flat^5 = 10.6$
$c^7 = 2.4$	$g^6 = 4.8$	$d^6 = 8.0$	$a^5 = 11.8$
$b^6 = 2.8$	$f\sharp^6 = 5.5$	$c\sharp^6 = 8.7$	

In this table the distances of the intervals are determined in a purely physical way and they have absolute value.

Alone the placing of  $e^7$  and 1.25 as equal is more or less arbitrary, for the intensities of the tones produced by the rods and whistle are not similar. Therefore it is possible that with the first another tone, probably lower than with the latter, is found to be the limit-tone. However, even in this case the presbycusic law remains unshaken, because the calculation of the intervals is independent of the absolute position of the tones.

Let us now convert into absolute pitch the 219 observations on normal ears of different ages. The curve allows us not only to find out for each case between which tones of the chromatic scale the limit-tone is situated, but also to determine most exactly the distance to the next higher or lower interval. Instead of giving the numbers we have preferred to give a graphic delineation, as in Plates III. and IV. Here again on the axes of ordinates are the heights of the tones, and on the axes of abscissæ the ages of the persons experimented upon. Each dot represents an observation. Together they form a sort of milky way which expresses in itself the presbycusic law. The system of dots sinks toward the right, toward the side where those of advanced

years are found. An average course can naturally be obtained from the mass of individual observations. The dots were grouped into periods of four years each, and the mean of each group calculated. A line, uniting the mean numbers thus found, may therefore be taken to represent the law. Examining the same, we find the upper limit as follows:

In the 7th year at  $e^7$ .

In the 14th year it lies a division lower.

Up to the 28th year it remains about the same.

By the 32d year it has reached  $d^{\sharp 7}$ .

In the 40th year it sinks to  $d^7$ .

In the 43d year it goes down to  $c^{\sharp 7}$ .

In the 51st year it is lowered to  $c^7$ .

In the 54th year it sinks to  $b^6$ .

In more advanced age it sinks still lower.

All in all five half tones are lost up to the beginning of advanced age. Later the average person loses about two half tones more. Perhaps we may be allowed to place the total presbycusis contraction of the upper part of the scale at an interval of one fifth, that is from  $e^7$  to  $a^6$ . From these average values the single observations vary more or less. For the first half of life the variations do not exceed half a tone; later on, in the second half, the variations can reach a whole tone. A practical otology will have to take this into account.

The formulation of the law, as just given, is evidently somewhat different from that which I advanced formerly in the *Archiv f. Ohrenh.*, Bd. xxxii., S. 53, and which was accepted by Gradenigo in his article on labyrinth diseases in Schwartz's handbook. The difference is only apparent however, for we must bear in mind that the numbers in the present paper correspond to average values, while the former investigations were to determine the limit where the normal ceases, and the pathological begins. If we examine the plate from this standpoint, it is evident that the investigations in the year 1890 are still of exact value. This is to be wondered at, because, at that time, very inexact methods were used in finding the absolute pitch of the whistle.



The average presbycusis is therefore to be reckoned to be an interval of one fifth, that is to say, the contraction of the upper limit is, on an average, from  $e^7$  to  $a^6$ . A presbycusis may be considered normal, however, which is as much as a sixth, that is to say, a senility of the organ of hearing reducing the upper limit from  $e^7$  to  $g^6$ .

Let us return to the observations from which we formulated the law. We find some differences if we compare the original numbers, not yet converted into denominations of absolute pitch, with those of Bezold. (The numbers of Bezold do not admit of such conversion.) One difference is that the Bezold numbers form less regular rows, and a second is that the average values for youth and extreme old age are not separated so widely from each other. These differences make the law less evident from Bezold's statistics. The causes can be two-fold. In the first place, Bezold extended his examinations to persons having a slight reduction of normal acuteness of hearing. The influence which individuals with a hearing distance for whispering of between 5 and 8 or even 10 *m* exercises on the average values, must lead to some error imperceptible in advance. The chief reason for our differences is due, however, if I do not err, to differences in the Galton whistles.

Bezold's has (as mentioned l. c., S. 262) so many accompanying sounds that, in the beginning, the feasibility of making the examinations was doubted. Mine is, on the contrary, nearly free from accessory noises. Accident brought this instrument into my hands, as it is the best of seven with which I was able to experiment.

The cause of the accessory noise, coarse errors of construction excepted, can be owing to either an improper distance between the slit and the lip of the whistle, or to the three-edged, cut-off shape of the slit.

The first cause is active when the instrument maker chooses a distance which is most fit for producing a tone which lies an octave below the limit-tone for youth. Then 6.8 of the scale will be the preferable length of the whistle. The normal limit tone can, however, be produced only with very sharp accessory noises, and the instrument will appear unfit

for investigations such as ours, although of use in pathological cases. The second of the above causes is nearly always present, and asserts itself more or less. A perfectly pure tone is theoretically not to be expected. I am trying to better these defects by a small alteration in the construction of the whistles, and hope to be able thereby to essentially increase their usefulness. As it is now, one must select a fairly good specimen from a larger assortment.

The presbycusic law can be studied, however, more or less exactly with theoretically incomplete instruments, only one must not be surprised if the several observers come to different quantitative results. Qualitatively the estimations are always similar, as mankind is, in all places, similarly constituted, and the Galton whistles, in all essentials similarly constructed. There exists, therefore, only a quantitative difference between Bezold's figures and mine, a difference great enough, however, to cause Bezold to attribute to presbycusis a far less importance than I have felt justified in doing.

Taking the above data as a basis, none of our readers will declare it hazardous if I now conclude:

1. The compass of the human hearing contracts a half octave at its upper limit up to the period of advanced old age. (Average a fourth, maximum an one fifth.)
2. During advanced age proper the contraction of the scale increases.
3. The upper limit is in youth at  $e'$ , in advanced age at  $a''$ , (average values). As extreme,  $g''$  becomes the limit in normal hearing old people.

A lower limit may be taken as a sign of pathological conditions.

## A HITHERTO UNDESCRIBED COURSE OF A DISEASE OF THE MASTOID PROCESS.

BY PROF. S. MOOS, HEIDELBERG.

Translated by Dr. J. A. SPALDING, Portland, Me.

(With three Figures on Plates V. and VI. of vol. xxiv, German Edition.)

THE chief role in this case was played by the mastoid fissure, which forms upon the exterior of the mastoid process the continuation of the petro-squamous suture. Gruber first <sup>(1)</sup> called attention to its importance, and later, Kirchner <sup>(2)</sup>, Kiesselbach <sup>(3)</sup>, and Bezold <sup>(4)</sup> have gone still deeper into the subject. I will give an abstract of their statistics at the end of this paper, which contains the results obtained in the Heidelberg Anatomical Collection.

Kirchner refers to three cases of mastoid disease in elderly people in which the chief role in the rapid extension of the morbid process upon the outer surface of the bone was played by the squamo-mastoid fissure. His cases were especially characterized by persistent pharyngeal catarrh, extending into the middle ear without perforation of the *Mt* with but little if any pain, and in two cases by a relapse of the mastoid swelling in from a fortnight to four weeks.

I have but once seen a case like these of Kirchner's with chronic pharyngeal catarrh, tinnitus, and deafness with neg-

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<sup>1</sup> *Wien. Med. Wochens.*, 1867, No. 53.

<sup>2</sup> *Archiv f. Ohrenhlkde.*, xix., p. 190.

<sup>3</sup> *Archiv f. Ohrenhlkde.*, xv., p. 238.

<sup>4</sup> *Archiv f. Ohrenhlkde.*, xiii., p. 51, and *Deutsche Med. Wochens.*, 1881, No. 28.

ative condition of the *Mt*. A painless abscess as large as an egg formed within a single day and disappeared rapidly after making an incision. In after years there were frequent relapses of the aural catarrh, without the former mastoid complication.

Bezold, I may remark, has repeatedly called attention to the fissure in question as a cause of *rapid* mastoid abscesses in children.

The fissure of which we are speaking runs from the incisura parietalis in an oblique direction over the mastoid process, and either reaches quite out to the stylo-mastoid foramen, or ceases this side of the same. In the former case it is called complete, in the second incomplete. (See Fig. 1). From a practical point of view this distinction is of insignificant importance, whilst the distinction between a *genuine* and a *pseudo-fissure* (See Fig. 3) is of more importance, inasmuch as the genuine fissure may excite rapid extension of the suppuration upon the external surface of the mastoid, whilst the pseudo-fissure with its more or less numerous cavities or crevices in the bone itself only favors the passage of *slighter masses* of suppuration along the vascular sheaths.

Mr. C. a robust man, suffered from scarlatinal otitis in each ear in childhood. The discharge persisted on both sides up to February, 1892, when he had an attack of influenza. On his recovery a fresh discharge appeared in the right ear but without any pain, and leading rapidly to a tumefaction over the mastoid process, at times larger, then again decreasing spontaneously in size. At one time it disappeared entirely. The aural suppuration also varied in amount. When it was small the patient had much headache. At one time the neck was swollen and very painful.

Present condition, May 31, 1892.

Pharyngeal catarrh; large central perforation in left *Mt* but no suppuration. Right ear, profuse suppuration, small perforation, *Mt* congested, pus in the tympanum, mastoid swollen, but not painful to the touch. Pressure over the mastoid causes increased otorrhœa.

The patient cannot raise himself in bed, but once up, he can sit without support. He cannot however rest on either arm on account of pain, extending along the neck and spine. All attempts

to move the head in any direction cause violent pain. Owing to this no instillations could be made into the ear.

Hearing: Conversation at  $\frac{1}{4}$  M. Fork A—1 not perceived, the others up to the twiced scored octave feebly perceived. Watch only by B. C. and 2 cm in the left ear. Repeated paracentesis *Mt* and removal of abundant masses of pus by syringing. Apparent cessation of the suppuration on the entire day of June 8, when suddenly at night there was so abundant a discharge of pus from the right meatus that a cup had to be held beneath to catch it. Staphylococci were discovered in some specimens.

As the affection seemed to be mastoiditis, an operation was performed on the next day, and seemed all the more indicated as the excessive flow of pus had continued for several hours.

The usual incision was followed by so abundant hemorrhage that six vessels had to be ligated; and the parenchymatous bleeding was so great that tamponage had to be resorted to for a long time before the operation could be proceeded with. No pus being found at a depth of 1.8 cm in the bone, nor any about the entire field of the operation, I then desisted. Two sutures were applied with iodoform gauze. In four weeks the incision was healed up from the bottom, without any rise in temperature.

So far as the ear was concerned the case ran on in this way: Up to June 8th, four days after the operation, no secretion; but during that evening *abundant discharge from the meatus*.

This lasted till nine the next morning when it again ceased, only to reappear in abundance the same evening, and to continue, though in daily diminishing amount, till the 17th of June, when it was very slight.

On the 28th of June, after massage over the mastoid for a few days previous on account of a doughy feeling over that region, the discharge burst forth once more in abundance from the lower end of the old incision, but for only three or four hours, when it again disappeared. The pus was driven out by massage over the mastoid, during which process much vertigo was complained of by the patient.

July 2 no swelling over the mastoid, no trace of aural suppuration.

Pharyngeal catarrh and a painless course characterized this case as well as that of Kirchner's. The pus enlargement lay at the lowermost end of the apophysis, and a little

to the middle line, but the greater part of the apophysis was free from swelling. The cells of the mastoid contained no pus at all; the antrum was probably obliterated, for I never succeeded in syringing through from the external meatus. This sclerosis originated in all probability from the scarlatinal otitis.

The pus-swelling at the lower end of the apophysis was *intermittent*. So was the discharge from the meatus. Its profuse reappearance after several days of quiescence was evidently due to the regurgitation of the pus from the abscess through the squamo-mastoid fissure. The stiffness of the neck and pain all along the back and neck were caused by inflammatory infiltration of the inter-muscular connective tissue, caused by previous sinking of pus.

The vertigo and tinnitus appearing during massage were due to more violent pressure upon the labyrinthine windows. The absence of the same symptoms at a later stage showed that the suppurative process had ceased. The entire course of the affection proves that in such cases trepanation of the mastoid and even Wilde's incision are unnecessary. At all events massage carefully performed should precede surgical manipulations.

RESULTS OF EXAMINATION OF FISSURES, PSEUDO-FISSURES  
AND CRACK-LIKE BONY CAVITIES IN THE COLLECTION  
OF SKULLS IN THE ANATOMICAL INSTITUTE AT HEI-  
DELBERG.

Total number of skulls 239, of which 29 were from children.

Three various types of particular formation of fissures on the mastoid process:

I. Type of the true fissure in the anatomical sense, beginning at the incisura parietalis squamosa of the temporal bone, runs on the mastoid process to its tip, and then bends forward and upward toward the external auditory meatus. The linea semicircularis occipitalis superior runs separate behind the mastoid fissure to the point of insertion of the sterno-cleido-mastoid muscle.



II. Total absence of the fissure. Well-marked tuberosities on the mastoid, a small emissary high up, a little higher still than the spina supra meatum. The linea semicircularis occipitalis superior does not extend to the mastoid process. The chief emissary lies in the occipital bone.

III. Type of the pseudo-fissure formation.

a. The linea semicircularis occipitalis superior extends into the exceedingly well-marked tuberosity, the zigzag projecting edges of which simulate a fissure. The emissary is at the upper beginning of the pseudo-fissure.

b. Type of the pseudo-fissure which is so highly developed, that there is a deep split, probably caused by the abundant holes in the vessels. In this the upper portion of the tuberosity exhibits no fissure at all.<sup>1</sup>

#### SUMMARY.

Two hundred and thirty-nine skulls in all, exhibit some sort of a fissure of the three above types 54 times, that is to say, about 22 per cent.

Perfect fissures in 24 skulls, 11 times double, 4 times on the right side alone, and 9 times on the left alone.

According to Kirchner and Kiesselbach, the fissure remains as a complete suture in the first year of life only.

Kirchner found this closed in 77 per cent. of adult skulls, in a collection of 300. Fifteen were double and 17 unilateral, that is, in 5 per cent. closed on both sides, and in 5 per cent. unilaterally closed, of which but 4 were on the right perfectly closed.

Bezold found the fissure persistent but 4 times in 200 skulls, and in 122 suggested by holes and crevices on the external surface.

The following table, in conclusion, gives some interesting statistics:

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<sup>1</sup> Here follows in the original a long and minute description of the 54 skulls in which various fissures were found, but which is here omitted for want of space. Those interested are referred to the original.—Translator.

The Mastoid-Squamous fissure is,		1 entirely open.	2 middle closed.	3 middle and upper third closed.	4 middle and lower third closed.	5 upper third closed.	6 middle alone open.	7 lower end open.	8 direction suggested by holes and crevices.	9 closed.
Age.	Temporal Bones.									
1	52	17.30	19.23	13.46	5.77	11.54	—	28.35	—	3.85
2	26	—	—	19.20	3.80	—	—	23.10	—	53.90
3	46	4.35	—	—	—	4.35	2.18	39.13	17.39	32.60
4	52	—	—	11.54	—	3.85	7.70	25.	17.30	34.61
5	38	7.98	—	—	—	5.26	2.63	23.68	13.16	47.38
6	32	—	3.12	—	—	—	6.25	6.25	3.125	81.25
7	30	—	—	6.7	—	13.3	3.3	10.0	16.66	60.
8 to 10	24	—	—	8.33	—	—	—	4.17	16.66	70.84
11 to 15	30	10.	—	10.	—	—	10.	3.3	6.77	60.
16 to 19	18	—	—	11.11	—	—	—	—	22.2	66.67

*Explanation of the Figures.*

These are all natural size.

Figure 1.

Stp = Sutura temporoa-parietalis.

Smsc. = Sutura mastoidea-squamosa completa.

Sot = Sutura occipito-temporalis.

Figure 2.

Stp. = As before.

Sot. = As before.

Smsi = Sutura mastoidea-squamosa incompleta.

Im. = Incisura mastoidea.

Figure 3.

Stp. = As before.

Admstcl. = Insertion of the sterno-cleido-mastoid muscle.

Psf. = Pseudo fissure, which at a glance is hardly to be distinguished from the true fissure, but which in its totality is impermeable even for the passage of a fine thread.

### Book Review.

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**Atlas of Laryngology and Rhinology.** By A. GOUGUEN-HEIM and J. GLOVER. Large folio. Masson, Paris, 1894.

This comprehensive and exhaustive work from the press of G. Masson, Paris, merits a more lengthy review than is practicable in these pages. The first chapter of the text is devoted to the topographical anatomy of the larynx, the nasal cavities, and the rhino-pharynx considered internally; followed by a consideration of the accessory sinuses, and the septum narium. The anatomy of the maxillary sinus or antrum has received we believe for the first time the attention it deserves. Several cadaveric sections show the anomalies which we are apt to encounter in attempting entrance by operative procedure through the inner wall of the sinus. The author reminds us that at times the middle meatus is a dangerous locality to perforate even for diagnostic purposes, as it sometimes impinges on the orbit, on account of the varying position of the insertions of the turbinate bones, especially the middle ones. In exploratory puncture of the antrum through the inferior meatus, which is recommended, we are reminded that the venous system of the longitudinal sinus may connect through the anterior ethmoidal veins, and become a remote seat of septic absorption, from an injury to the continuity of the mucous membrane within the meatus. These accidents which may infect, through the medium of the venous sinuses, the dura mater and the meninges, should cause us to look well to thorough antisepsis. Alveolar penetration in empyema is not recommended on account of the loss of the molar, and presenting insufficient space for investigation or cleansing purposes. The fenestration of the canine fossa by a free opening is advocated where one may see by the unaided eye or by means of an electric lamp in the corresponding

nasal fossa the entire interior of the cavity and have plenty of room for operative work and good drainage.

The relationship of the sphenoidal sinus to the adjacent nerves and venous sinuses, is well illustrated by a series of beautifully executed plates. The anatomy of the frontal sinuses is admirably shown by sections; the methods of catheterization of the different accessory cavities are described, and also the means and locations for the employment of the trochar for diagnostic purposes. This is followed by a detailed description of the authors' technique in the free opening and exploration of the various sinuses. In this respect the work is in advance of anything as yet published. Color is made use of to show the relations of adjacent veins and arteries. A table of distances in centimetres to be made use of in operative procedures is of especial interest. For instance, the distances as regards the frontal sinus are given as follows: from anterior nares to frontal sinus, 6 centimetres to 6.5 *cm* in tapping floor; 7 to 7.5 *cm* or thereabouts in practising catheterization of the sinus by the fronto-nasal duct and natural orifice.

The second chapter of the text is devoted to explanation as to the examination of the larynx, anterior and posterior rhinoscopy, and the clinical appearances of the different affections of the same. The benign, syphilitic and malignant tumors of the larynx are well described. The plates, however, are not equal to those of Krieg.

The nasal affections and septal deformities are not given as much attention as we would expect, nor are the plates particularly well drawn; however, there are indications that foreign otologists are beginning to realize the importance of intra-nasal surgery, and the attention given to the question of adenoid tissue at the pharyngeal vault and its removal, in which connection are displayed some excellent plates, tends to compensate one for other omissions.

The third chapter deals with pathological anatomy, and the plates of adenoid sections are excellent. The author explains the difficulty of getting autopsies on patients with laryngeal and nasal affections who die of intercurrent diseases, a position well understood by laryngologists. Under the heading "Compression of the Recurrent Nerves," a most excellent description is given of the various pathological conditions which are oftentimes so puzzling to the diagnostician. The author shows in a beautiful plate the chain of hypertrophied lymphatic ganglia in proximity to the

recurrent laryngeal nerves, very difficult to find on dissection, but so frequently observed in autopsies in the cancerous or tubercular subject. We have observed this fact which the author dwells upon, having found during the past year in two autopsies that the hypertrophy of these glands was the only condition which accounted for a paralysis of the left cord, accompanied by distressing and incessant cough—one in a case of cancer of the stomach, and the other in a case of pulmonary tuberculosis. These ganglionic lymphatic hypertrophies are most important to recognize, and the subject is well treated. There is no mention of cough as a symptom in the clinical description, though paralysis and laryngeal spasm are spoken of. Aneurism of the ascending arch of the aorta and compression by direct pressure of a carcinoma are also described and figured.

Chapter fourth, whose scope is explained in the short preface, deals with the principal operations which are generally done in the superior respiratory channels. The engravings show the positions of the hands and the instruments *in situ*, by means of plates made from photographs of sectional heads furnished by the *École pratique*. The pictures are very graphic and instructive, of inestimable value to the student and practitioner remote from special aid.

After teaching the ablation of adenoids, the use of laryngeal forceps, the saw and snare, the author gives valuable space to the description of that most questionable operation dipolar electrolysis of Garel, Moure, and Bergonié, for the removal of septum deflections. We have already seen too many of the terrible dry cicatrices following the roasting of the tissues, and condemn heartily any proceeding so unsurgical and disastrous in its results. English and American surgeons have already abandoned this operation as well as the use of the thermo-cautery upon the septum narium. Some good points are given in this chapter on the *modus operandi* of opening the maxillary and frontal sinuses, and the manner of tamponing the nose. The sphenoidal sinus the author leaves in the same obscurity with which other writers surround it. The consideration of operative work is dismissed entirely. The author says, apropos of inflammation of this sinus, they are observed especially by the oculist. "We have observed two cases of alteration in the function of this sinus coincident, it is true, with a grave affection of the face and the nose, with marked eye symptoms, exophthalmus and amaurosis."

We confess to no small amount of disappointment, in our review of this portion of the work, to have found no new and original material, for it is our belief that this question of the sphenoidal sinus and posterior ethmoidal complications will in the near future receive a great deal of attention from oculists and rhinologists.

The treatment by intubation and tracheotomy, laryngotomy and laryngectomy receives very excellent handling both in simplicity of text and clearness in illustrations. The steps in the operations of tracheotomy are better illustrated than in any work with which we are familiar.

Following the forty-eight ten by fourteen inch pages of the text, are over thirty-five elaborate plates, with explanation in French and English of the numerous figures. The text of the book is only in French, but the English description of the plates is quite full enough to make the book very valuable for reference and study to one unacquainted with the French language.

On the whole the volume is the best foreign topographical atlas on the subjects treated; theoretical consideration of the various topics is made subservient to practical suggestion, and careful study of the work is thoroughly rewarded. H. H. C.



## BRITISH NOTES.

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### APPOINTMENTS.

BABER, E. CRESSWELL, M.B. (Lond.), L.R.C.P. (Lond.), M.R.C.S. (Eng.), has been appointed Surgeon to the Royal Ear Hospital, London.

BROWNE, EDGAR A., F.R.C.S. (Edin.), appointed Consulting Surgeon to the Liverpool Eye and Ear Infirmary.

CHEATLE, H. ARTHUR, F.R.C.S. (Eng.), has been appointed Assistant Surgeon to the Royal Ear Hospital, London.

Craggs, R. F., M.B. (Durh.), B.S., re-appointed Medical Officer to the Throat and Ear Hospital, Newcastle-on-Tyne.

HERRICK, R. W., M.D., B.Ch. (Dubl.), re-appointed Honorary Surgeon to the Nottingham Throat, Ear, and Nose Hospital.

HUDSON, C. LEOPOLD, F.R.C.S. (Eng.), has been appointed Aural Surgeon to the Middlesex Hospital, vice HENSMAN, deceased.

JOHNSTONE, JAMES, L.D.S.R.C.S. (Edin.), re-appointed Honorary Dental Surgeon to the Nottingham Throat, Ear, and Nose Hospital.

KENNY, A. L., has been appointed Surgeon in charge of the eye, ear, and throat, in connection with a new Hospital which has just been established at Melbourne, Australia.

LACK, H. LAMBERT, M.B. (Lond.), F.R.C.S. (Eng.), has been appointed Assistant Physician to the Hospital for Diseases of the Throat, Golden Square, London, W.

LEE, CHARLES GEORGE, M.R.C.S. (Eng.), has been appointed Aural Surgeon to the Royal Southern Hospital, Liverpool.

LODGE, S., JR., M.D. (Durh.), appointed Special Assistant Surgeon to the Bradford Eye and Ear Hospital, vice ANDREW LITTLE, M.B., C.M. (Aberd.).

LYLE, THOMAS, M.D. (Glasg.), has been appointed Surgeon to the Newcastle-on-Tyne Throat and Ear Hospital, vice BURWOOD, resigned.

MACALISTER, CHARLES J., M.B. (Edin.), M.R.C.P., appointed Consulting Physician to the Liverpool Schools for the Deaf and Dumb.

MOORE, E. COLEMAN, M.B., C.M. (Edin.), appointed Surgeon to the Edinburgh Ear and Throat Dispensary.

NEVINS, J. ERNEST, M.B. (Lond.), M.R.C.S., appointed Honorary Medical Officer to the Liverpool Schools for the Deaf and Dumb, vice MACALISTER, appointed Consulting Physician.

PARKER, CHARLES A., M.R.C.S. (Eng.), has been appointed Assistant Surgeon to the Hospital for Diseases of the Throat, Golden Square, London, W.

SHEARS, CHARLES H. B., L.R.C.P., M.R.C.S., appointed Surgeon to the Liverpool Eye and Ear Infirmary, vice BROWNE, appointed Consulting Surgeon.

STEVENSON, EDGAR, M.D., C.M. (Aberd.), appointed Assistant Surgeon to the Liverpool Eye and Ear Infirmary.

STEWART, DONALD, M.D. (Glasg.), L.R.C.S., L.M. (Edin.), re-appointed Honorary Surgeon to the Nottingham Throat, Ear, and Nose Hospital.

WATERHOUSE, HERBERT F., M.D., C.M. (Edin.), F.R.C.S. (Eng.), has been appointed Aural Surgeon to Charing Cross Hospital.

YEARSLEY, P. MACLEOD, F.R.C.S. (Eng.), has been appointed Honorary Aural Surgeon to the Farringdon General Dispensary.

#### SOCIETIES.

SHEFFIELD MEDICO-CHIRURGICAL SOCIETY.—At the meeting held on October 26, 1893, Mr. Atkin read a note on *The Treatment of Earache in Children*, advocating "breathing" into the

ear by the mother or nurse, and the use of aconite internally. For more severe cases he recommended blisters, etc., and instillations of atropine, morphine, and cocaine.

NORTHUMBERLAND AND DURHAM MEDICAL SOCIETY.—At the meeting held on November 9, 1893, Dr. Hume showed a case in which he had recently trephined for mastoid disease. No abscess had been found in the brain substance, and the lateral sinus was unaffected. Mr. Vickery also showed a case in which the internal jugular vein had been tied for thrombosis in the lateral sinus. It is, perhaps, worthy of note that in both these cases there appear to have been rigors after the operation, but the patients recovered perfectly.

MEDICAL SOCIETY OF LONDON.—At the meeting held on November 27, 1893, Mr. Ballance exhibited a case in which he had cleared out a clotted and pyæmic lateral sinus a month previously. There had been no rigors in this instance, and the recovery had been absolutely uninterrupted.

CLINICAL SOCIETY OF LONDON.—At the meeting held on November 24, Mr. Ballance demonstrated upon a patient the value of Heryng's method of trans-illumination in suspected cases of empyema of the antrum of Highmore.

BRITISH MEDICAL ASSOCIATION—Staffordshire Branch.—At the meeting held on November 30, 1893, Mr. Hatton read a paper on *Intracranial Complications of Chronic Otitis Media*, relating a case.

Oxford and District Branch.—At the meeting held on January 26, 1894, Mr. Victor Horsley gave an address on *Diseases of the Middle Ear and Their Operative Treatment*. The address was illustrated by means of lantern slides, and the steps of the operation of opening the mastoid antrum were demonstrated upon the dead body.

BRITISH MEDICAL ASSOCIATION—North Wales Branch.—At an intermediate meeting of this Branch, held at Wrexham, on April 3, 1894, Mr. Hugh E. Jones, of Liverpool, read a paper on *The Radical Cure of Otorrhœa*, strongly maintaining the importance of thorough clearing out of the tympanic cavity and free drainage. He related two cases, in one of which he had performed Schwartz's operation and in the other Stacke's.

North of England Branch.—At the meeting held at Morpeth

on May 3, 1894, Dr. Gowans showed the parts after operation for septic thrombosis of lateral sinus and jugular vein.

BRADFORD MEDICO-CHIRURGICAL SOCIETY.—At a clinical meeting held on Tuesday, December 19, 1893, Mr. Althorp showed a young woman with auricular fistulæ, and at the meeting held on January 9, 1894, he read a paper on the subject, in which he dealt generally with the developmental irregularities met with in that region.

NOTTINGHAM MEDICO-CHIRURGICAL SOCIETY.—At the meeting held on January 17, 1894, Dr. Hunter read a paper for Dr. Stewart on *Eustachian Obstruction*.

ROYAL ACADEMY OF MEDICINE IN IRELAND—SECTION OF ANATOMY.—At the meeting held on January 26, 1894, Dr. H. R. Woods showed a specimen of enlarged turbinated bones which had given rise to nasal obstruction, and which he had removed.

EDINBURGH MEDICO-CHIRURGICAL SOCIETY.—At the meeting held on February 7, 1894, Professor Annandale read a long and elaborate paper on *Intracranial Surgery*, and referred to the connection between intracranial disease and ear troubles. In the discussion which followed, Dr. McBride drew particular attention to this aspect of the question.

SHEFFIELD MEDICO-CHIRURGICAL SOCIETY.—At the meeting held on February 1, 1894, Mr. Arthur Jackson showed a curious fibro-gelatinous naso-pharyngeal polypus which he had removed from a female patient aged twenty-three.

At the meeting on February 15, 1894, Mr. Pye-Smith showed among other specimens, the temporal bone and lungs in a case of septic thrombosis secondary to chronic middle-ear disease in a boy of ten. The patient had been operated upon unsuccessfully.

At the meeting on April 12, 1894, Mr. Pye-Smith showed a brain with purulent meningitis secondary to middle-ear disease.

BRADFORD MEDICO-CHIRURGICAL SOCIETY.—At a meeting held on February 6, 1894, Dr. Adolf Bronner read a paper on *Intracranial Disease Secondary to Ear Disease*. He expressed the opinion that thrombosis was common in adults but rare in children, and that most cases would not require operation if the ear discharge had not at some time been neglected.

At the meeting held on May 1, 1894, Dr. Adolf Bronner showed

three cases in which he had operated for mastoid disease. In all the cases there was a history of ear discharge and pain over the affected region, but in none was there any rise in temperature, nor were the periosteum or superficial layers of bone affected, and it was only after chiselling down to a depth of six to ten millimetres that pus or granulation tissue could be found.

EDINBURGH MEDICO-CHIRURGICAL SOCIETY.—The debate upon Intracranial Surgery, opened by Professor Annandale, on February 7, 1894, was continued at the next meeting of the Society, and is well worth reading. The matter was discussed from nearly every possible point of view, and the large number and high professional standing of the speakers considerably enhance the value of the report.

LIVERPOOL MEDICAL INSTITUTION.—At the meeting on February 15, 1894, Mr. Hugh Jones reported a case of subperiosteal abscess following middle-ear mischief, the result of influenza. The patient was operated upon and was apparently doing well, but at the end of three weeks purulent meningitis set in and she died.

CLINICAL SOCIETY OF LONDON.—At the meeting on March 9, 1894, Mr. C. Mansell-Moullin related a case of cerebral abscess which apparently followed a blow over the mastoid. In spite of operation, the patient died, and at the post-mortem a very old encysted abscess was found in the left temporo-sphenoidal lobe, and it was thought that this abscess must have been latent for a long time, and had been roused into activity by the blow. In the discussion which followed, the opinion was expressed that the trocar and canula was a defective instrument for cerebral explorations.

MIDLAND MEDICAL SOCIETY.—At the meeting held on March 28, 1894, Mr. George Heaton showed a boy, aged twelve, who had had symptoms suggestive of the rupture of an intracranial abscess into the right tympanum.

#### NEW INVENTIONS.

Dr. Macnaughten Jones has devised an Aural Speculum, in which a hinged clip is attached to the proximal end for the reception of a convex lens, so that a magnified view of the membrane

may be readily obtained. The arrangement is figured and described in the *Lancet* of November 18, 1893.

Mr. H. Lake has suggested, and Messrs. F. Walters & Co. have made, a series of Aural Specula, the novelty of which consists in their being made of silvered glass covered with hard rubber, as in the ordinary Ferguson's vaginal specula. They are described in the *British Medical Journal*, of February 3, 1894, where also Messrs. Wright & Co. depict and describe an ingenious Ear Syringe Guard. The object of this invention is to obviate the possibility of accidentally thrusting the nozzle of the syringe too deeply into the meatus, an accident to which one is liable when dealing with very young or very restless patients.

#### MISCELLANEOUS.

In the *Lancet* of December 30, 1893, Mr. Lewis G. Glover, of the Victoria Park Hospital records a case of symmetrical herpes attacking the ears of a boy aged fourteen. The patient had had a similar attack in the autumn of each year for the last three or four years.

Mr. Santi contributes to the *Lancet* of January 13, 1894, an interesting paper upon *Hemorrhage following Tonsillotomy*. The paper is for the most part historical, and Mr. Santi, after quoting many authorities, comes to the conclusion that severe hemorrhage is extremely rare.

In the *Lancet* of February 17, 1894, Professor Annandale, of Edinburgh, gives a very clear and lucid account of his method of removal of large naso-pharyngeal polypi. The points upon which he appears to lay particular stress are: (1) Chloroform as the anæsthetic, the head being allowed to hang well over the end of the operating table; (2) the mouth being gagged, the soft palate is divided in the middle line, the flaps being held apart by means of silks previously passed on either side of the uvula; (3) the tumor is separated from its attachments by means of a blunt instrument such as a periosteal elevator, and the neck or pedicle being seized with a strong pair of forceps can readily be removed either through the mouth or through the nose; (4) the nasal cavities are plugged with iodoform gauze, and the halves of the soft palate stitched together.



The account given by Dr. Semon in the *British Medical Journal*, of February 3, 1894, of his personal sufferings under an acute attack of inflammation of the antrum of Highmore has led to other somewhat similar experiences being placed on record. In the *British Medical Journal*, of February, 1894, Dr. M. C. Moxham refers to his own case, and in the issue of the same journal, dated March 31, 1894, Mr. Lennox Browne records a case which had come under his own observation.

It is an extremely happy coincidence that Sir William Dalby's acceptance of the presidential chair of the Medical Society of London should have followed so closely upon the publication of his articles in *Longman's Magazine* on "Medicine as a Career." These articles, which are now issued in book form, are written on the lines of Lord Chesterfield's *Letters*, but are in no way copies or parodies of the latter in anything more than the mere outward form, at the same time they preserve in modern language those amusing touches of shrewdness, common-sense, and humor, which are so characteristic of the original letters.

At the Royal Institution, on Friday evening, March 2, 1894, Dr. McKendrick gave an interesting lecture upon the Cochlea. Dr. McKendrick was inclined to adhere to the older theory of Helmholtz, which assumes a selective action on the part of the organ of Corti, in opposition to the more modern idea that such selection does not occur until the vibrations reach the brain itself. The lecture itself contained, perhaps, rather more technical details than are usually presented to Royal Institution audiences.

At a recent conference of school boards in the northeastern towns, held at Middlesborough, under the elementary Blind and Deaf Children's Act of 1893, it was thought that several small institutions would be preferable to a few large ones.

In the *Lancet*, of April 28, 1894, Mr. W. Gosse, of Sittingbourne, Kent, publishes the details of a case of mastoid disease which had recently come under his care, and in which Mr. Marmaduke Sheild had operated, the patient making a good recovery.

At a recent meeting of the East Sussex Medico-Chirurgical Society, Dr. Stephen Mackenzie read a paper on *Aural Vertigo*, which is published *in extenso* in the *British Medical Journal*, of

May 5, 1894, and which drew from Sir William Dalby a very pertinent criticism in the journal of the following week. It is needless to say that Dr. Mackenzie's paper is an extremely able paper, and will repay perusal. In these days the general physician and the general surgeon are perhaps rather apt to magnify and make much of the knowledge which has accrued to them from the labors of the specialist, but, on the other hand, there is no doubt that the latter will always benefit from looking occasionally at their specialty from the point of view of the former.

Mr. W. J. E. Sumpter, in a letter to the *Lancet*, of May 5, 1894, records the subsequent history of a case referred to by him in the *Lancet*, of April 15, 1893, as being one of epithelioma of both external ears. Operative interference being refused by the patient, the malignant character of the affection became gradually more and more pronounced, and death occurred on January 13, 1894. Post-mortem microscopical examination of the growth left no doubt as to the correctness of the original diagnosis.

The question as to which is the best anæsthetic to use in operations for the removal of adenoid growths is one which has been much discussed of late, and has led to formal debates in two of the societies whose members are more directly concerned, viz. : the Laryngological Society of London and the Society of Anæsthetists. Some laryngologists and some anæsthetists appear to be strongly in favor of using nitrous oxide and ether to induce narcosis in the first instance, maintaining the anæsthesia, if need be, by means of chloroform ; on the other hand, probably an equal number were quite as strongly in favor of the employment of chloroform, or mixtures containing chloroform, throughout the operation. These debates and discussions have, however, brought out one very important fact upon which all appear to be agreed, viz. : that the chief risk lies in the anæsthetic, and it is therefore of the utmost importance that the greatest care should be exercised in the choice of a competent and skilled administrator, and that this responsible position should not be filled by one who has not been long accustomed to these cases.

By dividing the blades of a Kramer's aural speculum vertically, shortening them, and attaching a spring to the proximal ends in the manner of a Thudichum's nasal dilator, Dr. W. R. Stewart has provided us with a self-retaining aural speculum, of which he speaks highly in the *British Medical Journal*, of May 5, 1894.

## Obituary.

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We regret to announce the death of Dr. SAMUEL JOHNSTONE MOORE, of Blythswood Square, Glasgow, a popular and much respected member of the profession. Among the appointments which he formerly held was that of Physician to the Dispensary for Diseases of the Ear at Glasgow.

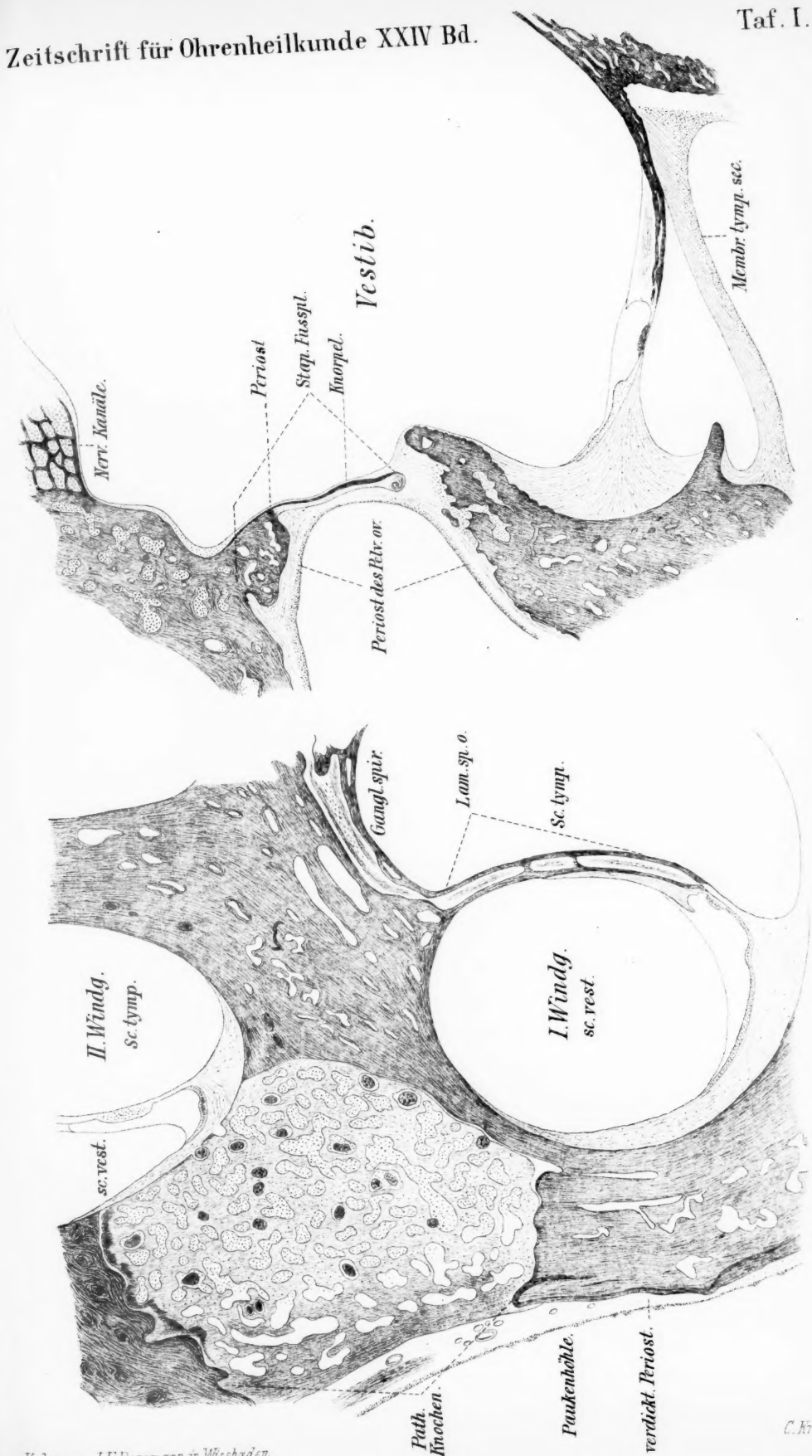
M. C. NIEL GRIFFITHS, of Cheltenham, died from the effects of a self-inflicted bullet wound, on March 10, 1894. Mr. Griffiths received his professional education at King's College, London, and at the time of his death held the post of Surgeon to the Throat and Ear Department of the Hospital for Sick Children at Cheltenham. He had devoted much time to the study of ear diseases, having held in succession the important posts of Clinical Assistant to the Royal Ear Hospital, Soho; Great Northern Central Hospital; Hospital for Diseases of the Throat, Golden Square; and for some time he was House Surgeon to the London Throat Hospital. His name is associated with a "New Self-Retaining Nasal Speculum and a New Self-Retaining Aural Speculum," shown at the meeting of the British Medical Association in 1891, and with a "Portable Laryngological and Aural Gas Lamp-Stand; and a modified Aural Polypus Snare, and Self-Retaining Nasal Dilator," described in the *British Medical Journal* for the same year (1891).

The duty of recording the death of a fellow-worker is always a painful one, and it becomes doubly so under the sad circumstances referred to above.

The published details connected with the death of a very eminent member of the profession (Dr. E. H. JACOB), at Leeds, on February 27, 1894, afford food for serious reflection on the part of all otologists. Early in January, Dr. Jacob suffered from what is described as "a small abscess in the membrana tympani," but, judging from the fact that opening this abscess was followed by a discharge from the meatus for three weeks and a short period of well marked vertigo, it would almost appear that the whole of the middle ear was more or less involved. Ear symptoms had ceased for a fortnight, when suddenly he was seized with pain in the head and vomiting, and rapidly became comatose. The mastoid and temporo-sphenoidal regions were operated upon, and

the cerebellum explored, but no good result ensued, and he never regained consciousness, but died within a few hours. The post-mortem examination showed that death was due to acute diffuse arachnitis, and "no trace of the initial ear disease was to be seen."

We regret to have to record the death of Mr. ARTHUR HENSMAN, F.R.C.S., Aural Surgeon to the Middlesex Hospital, and for many years Lecturer on Anatomy at the Middlesex Hospital Medical School. Mr. Hensman died of Bright's disease, on November 1, 1893, at the comparatively early age of fifty-one. He was a native of Northampton, and received his medical education at University College, London, and had held his appointment as Surgeon to the Throat and Ear Department at Middlesex Hospital since the year 1881. In the last edition of Holmes's *System of Surgery*, he contributed to the articles on Diseases of the Larynx, and more recently, in Morris's *Treatises on Anatomy*, he wrote the sections upon the Thorax, the Upper Part of the Digestive Tract, and the Larynx.



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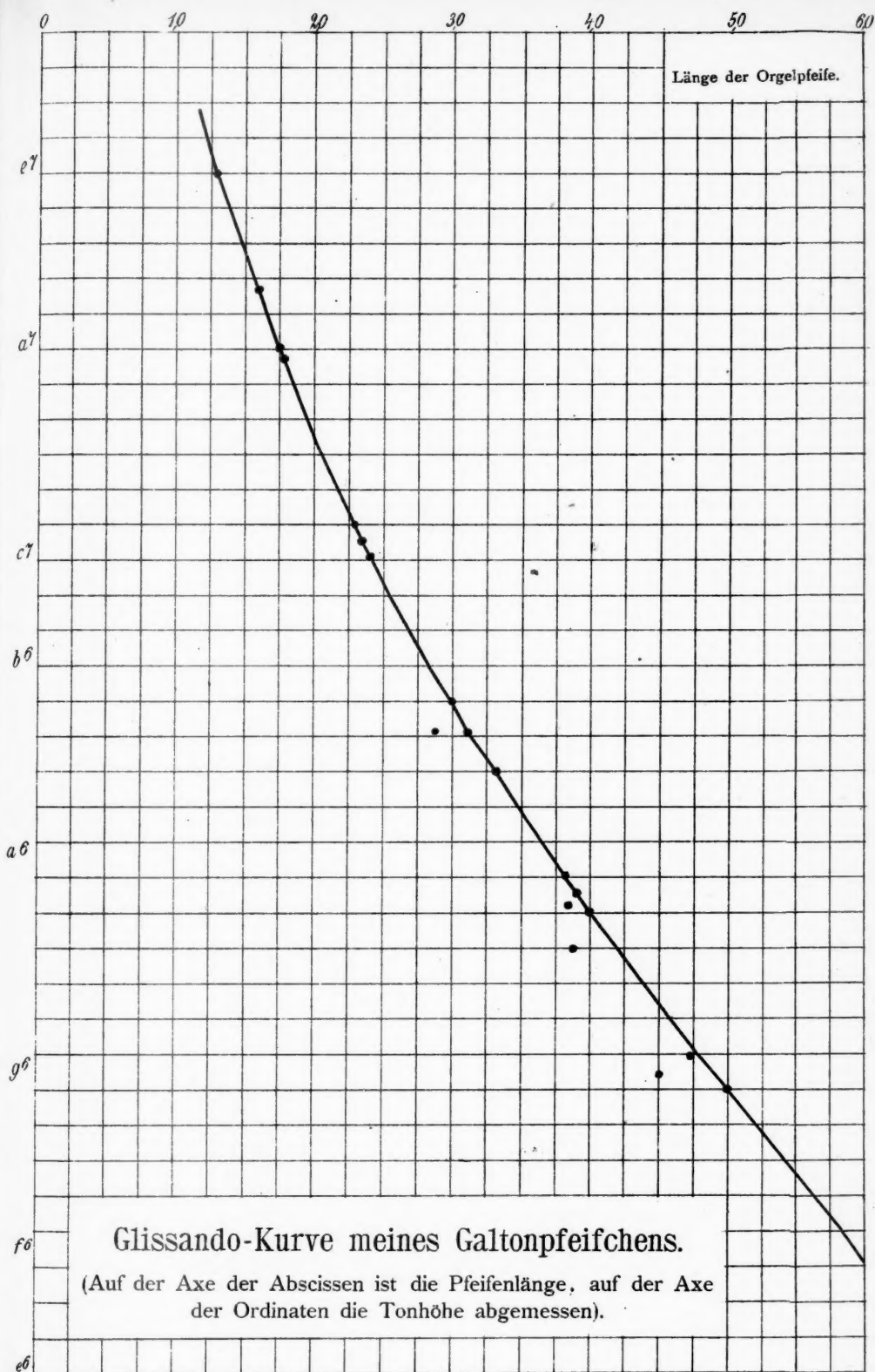
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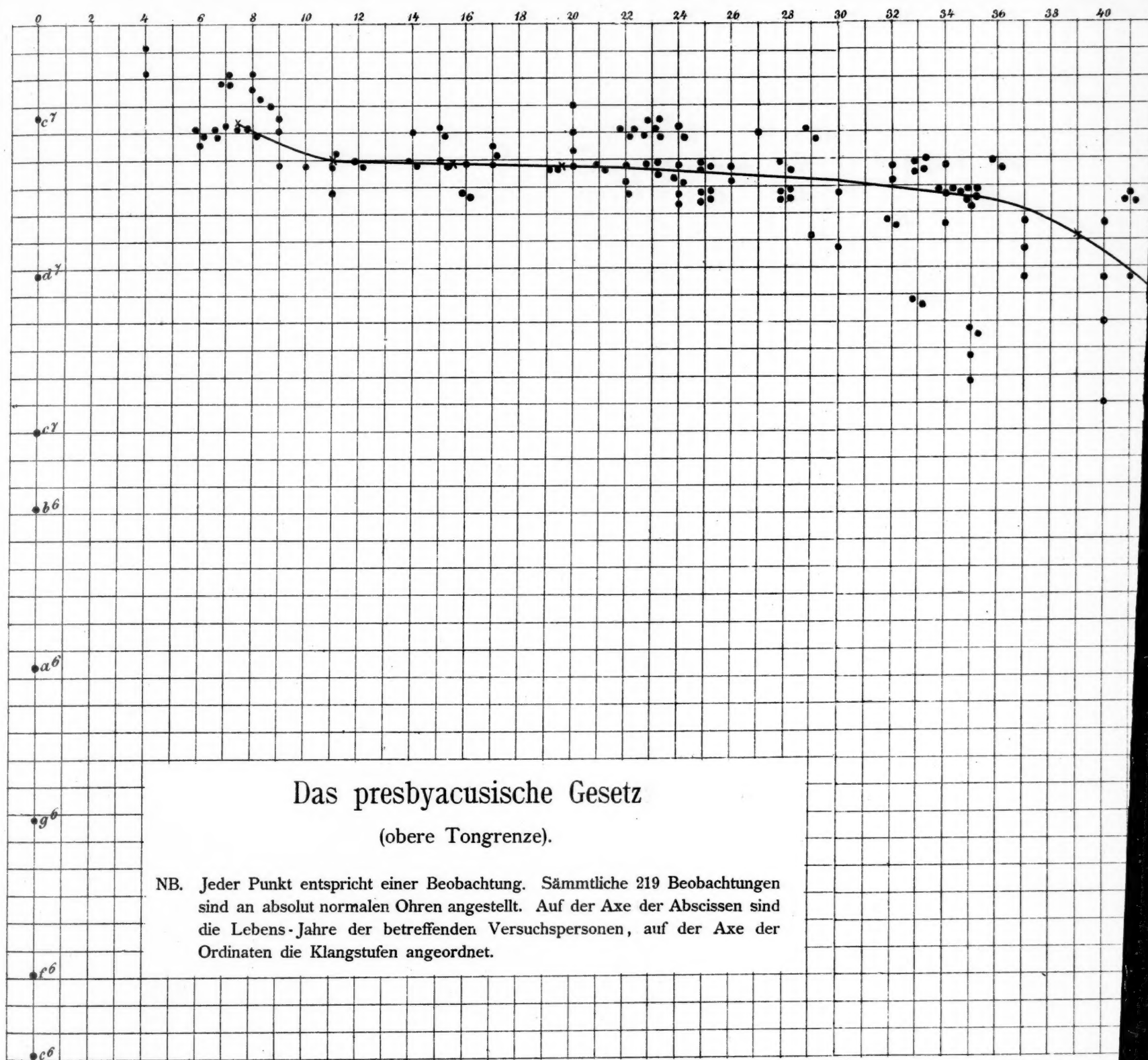
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### Das presbyacusische Gesetz

(obere Tongrenze).

NB. Jeder Punkt entspricht einer Beobachtung. Sämmtliche 219 Beobachtungen sind an absolut normalen Ohren angestellt. Auf der Axe der Abscissen sind die Lebens-Jahre der betreffenden Versuchspersonen, auf der Axe der Ordinaten die Klangstufen angeordnet.

PLATE III. Presbycusis Law (upper tone limits). Each point corresponds to an observation on absolutely normal ears. The ages of the individuals examined are put on the abscissas.

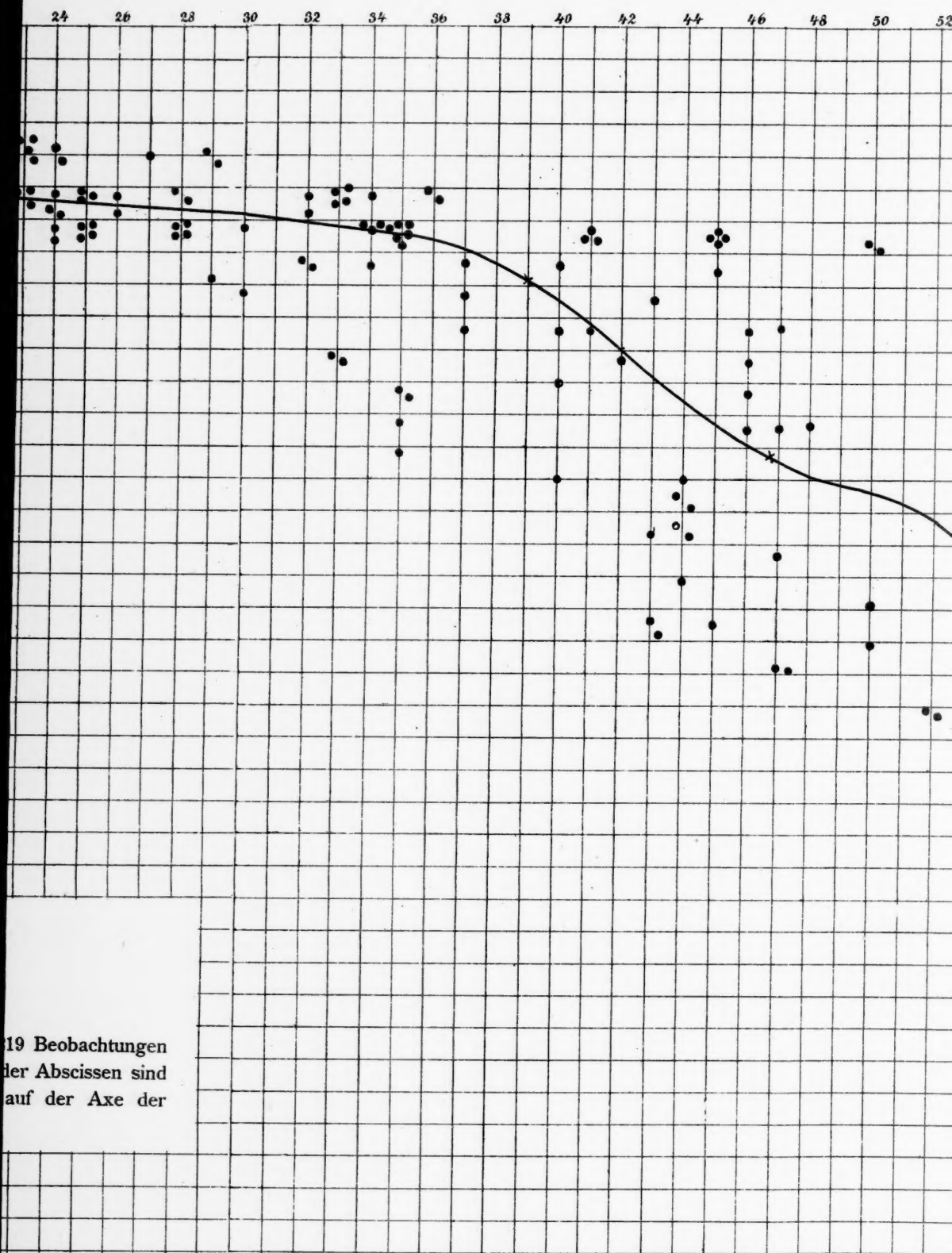
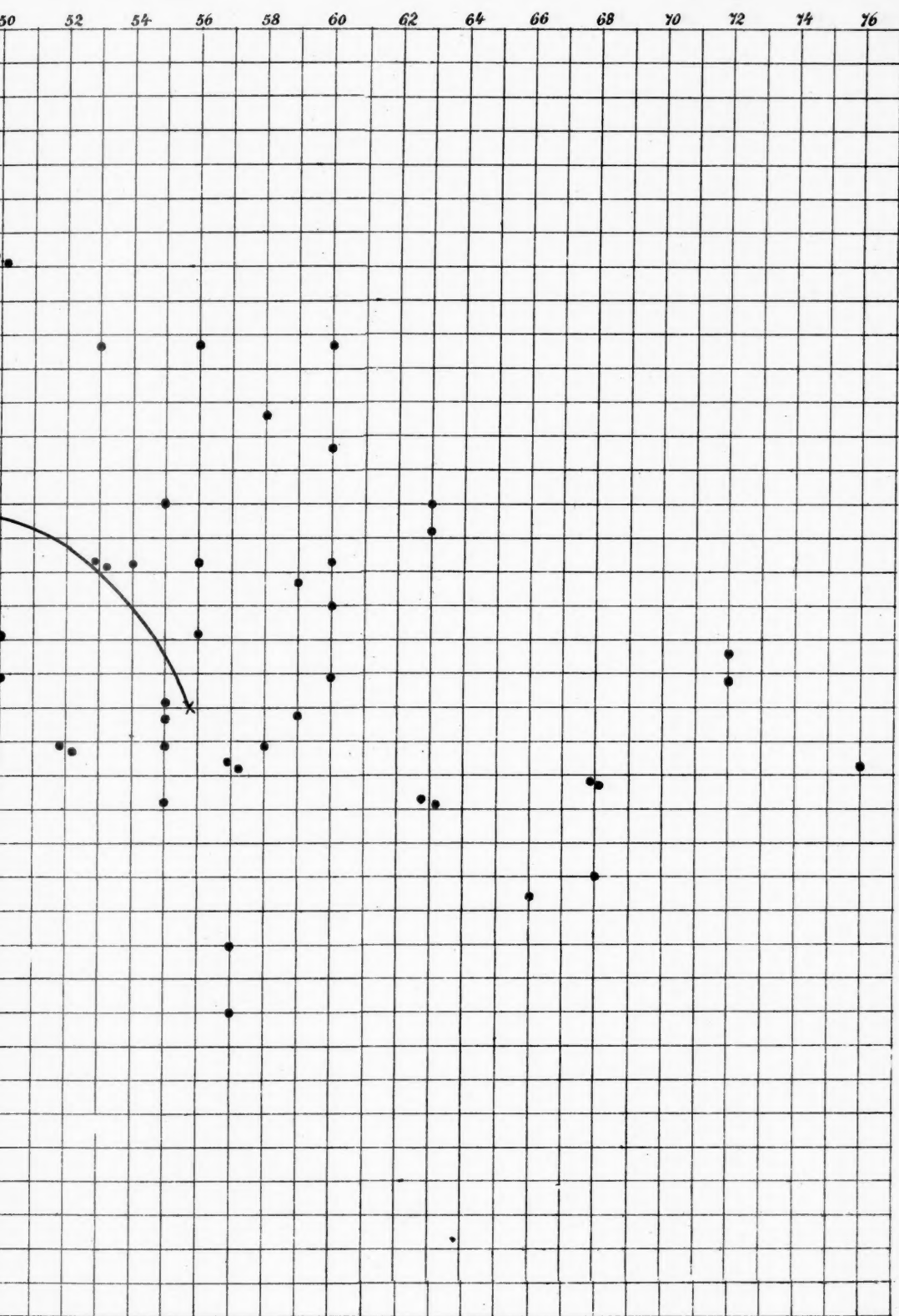


FIGURE III. Presbycusis Law (upper tone limits). Each point corresponds to an observation. The whole 219 observations are from normal ears. The ages of the individuals examined are put on the axis of the abscissæ; the pitch of the tones on the axis of the ordinates.

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Observations are on  
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Fig. 1.

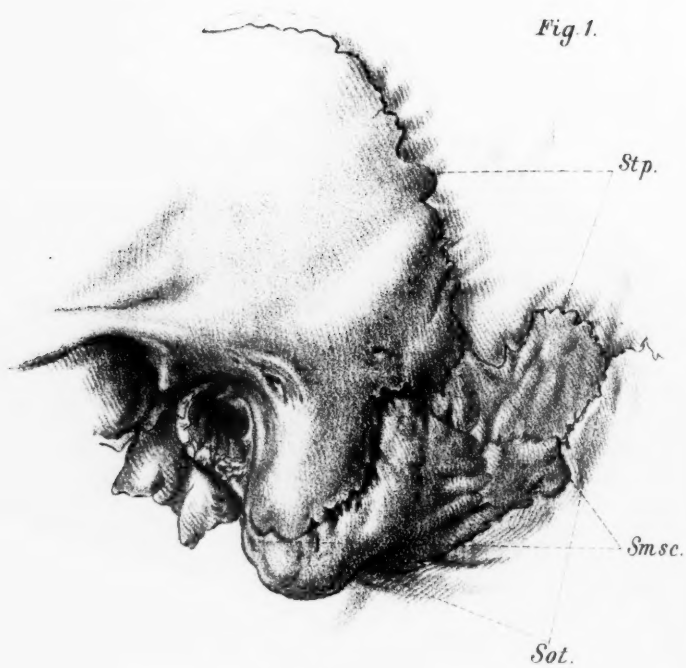


Fig. 2.

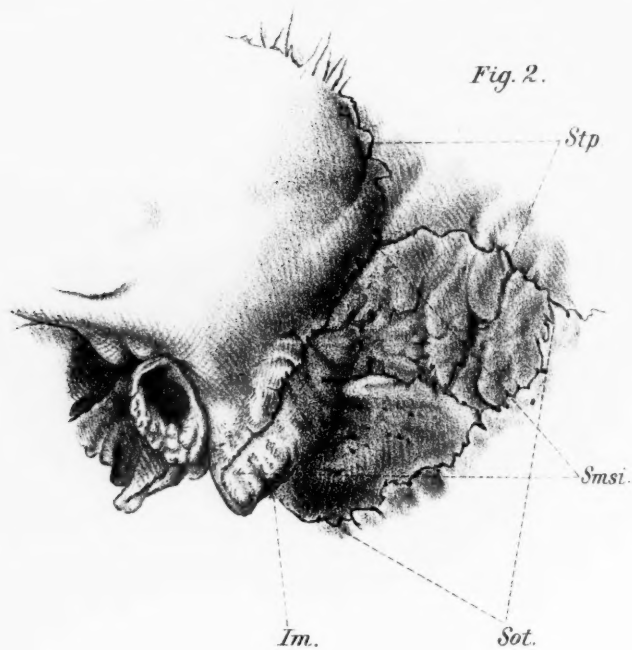




Fig. 3.

